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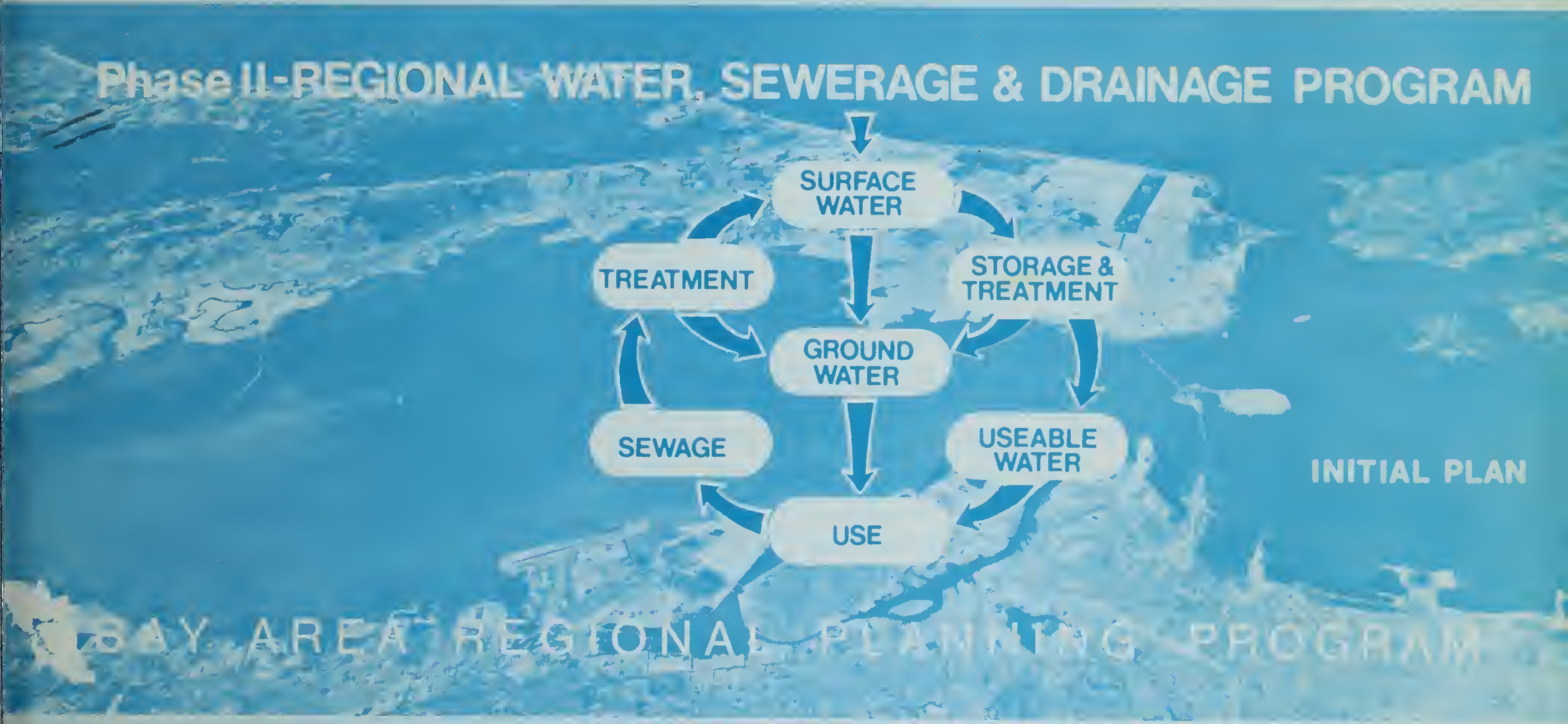
Phase II-REGIONAL WATER, SEWERAGE & DRAINAGE PROGRAM



INITIAL PLAN

BAY AREA REGIONAL PLANNING PROGRAM

ASSOCIATION OF BAY AREA GOVERNMENTS

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The Association of Bay Area Governments was created in January, 1961. It was founded in recognition of the fact that the physical, economic and social well being of the entire region and of its individual communities requires continuing, areawide cooperation and coordination of policies, plans, and services.

The primary function of the Association is to provide the framework for dealing with regional problems on a cooperative, coordinated basis. Although the Association is not itself a government agency, it provides the means by which strong, vital units of city and county government work together in solving regional problems and in formulating and implementing regional development policies.

Formal organization for the Association is provided by contractual agreement between the member cities and counties acting under the authority of the Joint Exercise of Powers Act of the State of California. Present membership includes eight counties and 84 cities representing collectively more than 99 percent of the total Bay Area population.

The primary objectives of the Association are:

The identification and study of problems, functions and services in the San Francisco Bay Metropolitan Area and the making of appropriate policy or action recommendations.

The review of proposals for metropolitan or regional governmental agencies and the making of appropriate policy or action recommendations.

Such other metropolitan or regional functions as are determined by the Association to be appropriate for consideration.

The Association currently is active in the following fields: regional planning, water, sewer and drainage planning, open space and recreation planning, regional housing policy, criminal justice planning, regional information systems, regional airport systems planning, and regional economics.

The Regional Planning Program, financed in part by a Federal Urban Planning Assistance Grant, is designed to produce a comprehensive regional plan and continuing planning process to assist in the growth and development of the region. A full-time planning staff, working in close cooperation with local agencies and other regional units is now completing the regional plan, a general land use plan including open space, residential, commercial and industrial land use patterns as well as transportation and institutional uses.

The Association's programs are financed by membership dues and special assessments and by grants in funds and services from other regional agencies and state and federal governments.

The preparation of this report was financed in part through an urban planning grant from the Department of Housing and Urban Development, under the provisions of Section 701 of the Housing Act of 1954 as amended.

PHASE II
REGIONAL WATER, SEWERAGE, AND DRAINAGE PROGRAM

INITIAL PLAN

PREPARED FOR THE

ASSOCIATION OF BAY AREA GOVERNMENTS
CLAREMONT HOTEL, BERKELEY, CALIFORNIA

BY

METCALF & EDDY/ENGINEERS

SEPTEMBER, 1971

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FOREWORD

The Association of Bay Area Governments is involved in a three-phase regional water resources planning program as follows:

Phase I - Inventory and Study Design
Phase II - Initial Plan
Phase III - Continuing Program for a Fully Developed Plan

This report represents the accomplishment of Phase II, an Initial Plan for Water, Sewerage, and Drainage in the San Francisco Bay region.

Phase I of the program, "Inventory and Study Design," was published by the Association in July 1970. Phase II work was done largely by Metcalf & Eddy, consulting engineers of Palo Alto, California, under close review by regional planning staff and the Regional Planning Committee.

Phase II is intended to serve as the preliminary regional water, sewerage, and drainage plan required by the Department of Housing and Urban Development. As such, it will provide a guide for grant review until a "fully developed" plan has been prepared and adopted, during the Phase III program.

It should be noted that the Interim Basin Plan for Water Quality Management recently developed and adopted by the Regional Water Quality Control Board and the State Water Resources Control Board is intended to serve as a guide for grants of both Federal and State funds for major facilities construction for water pollution control.

The State Water Resources Control Board and the Regional Water Quality Control Board are embarking on a program to develop and adopt a regional plan for water quality management by July 1, 1973. ABAG will participate as a team member in that program and it is expected that a joint plan for water quality control can be realized.

However, the ABAG planning responsibility extends well beyond the scope of the State Board program, including also the areas of water supply and distribution as well as storm drainage and flood waters. Therefore, the continuing ABAG program for a fully developed water resources plan must encompass all aspects of water resources, including planning for water quality management, and integrate them within a broad and total water resources planning program for the San Francisco Bay region. No other agency, no other existing or proposed planning program, has accepted this responsibility.

Phase III, therefore, of the Association's continuing water, sewerage, and drainage planning program will involve the following activity:

(1) Participation with the State in the development of a "final" regional plan for water quality control.

(2) Receiving and analyzing response to the Phase II study.

(3) Incorporation of pertinent results from other studies and research accomplished in the interim.

(4) Responding to related actions of the State Legislature in 1971 and 1972.

(5) Continuing the regional planning effort in water supply and drainage.

(6) Combining all aspects of water resources planning in the Bay region into a coordinated program.

(7) Presentation of a medium (10-20 years) program to schedule necessary improvements.

(8) Studying methods for continuing planning and program revisions as conditions change.

(9) Presentation of a final plan for approval and adoption.

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ABBREVIATIONS

ABAG	Association of Bay Area Governments
BATSC	Bay Area Transportation Study Commission
EBMUD	East Bay Municipal Utility District
ENR	Engineering News-Record
FCD	Flood Control District
HUD	U. S. Department of Housing and Urban Development
SFWD	San Francisco Water Department
SPRR	Southern Pacific Railroad
USBR	U. S. Bureau of Reclamation
WPRR	Western Pacific Railroad

acre-ft	acre-feet
BOD	biochemical oxygen demand
cfs	cubic feet per second
DWF	dry weather flow
max.	maximum
MG	million gallons
mgd	million gallons per day
mg/L	milligrams per liter
NIR	no information received
O & M	operations and maintenance
R/W	right-of-way
STP	sewage treatment plant
WPC	water pollution control

Chapter 1

INTRODUCTION

To be eligible for federal financial assistance from HUD (U. S. Department of Housing and Urban Development), water and sewerage (including drainage) projects must be consistent with a short-range program and must be adequately related to long-range areawide regional planning. In establishing an areawide system, HUD stated in its guideline [1] that:

1. Any proposed project must be consistent with a short-range, areawide water or sewer system program.
2. The areawide program must be based upon long-range, areawide water and sewer planning.
3. Water and sewer planning must be part of long-range, areawide comprehensive planning.
4. Comprehensive planning must be conceived and carried out to attain urban area goals and objectives under the policy direction of local elected officials.

The areawide program required by HUD must be an "officially coordinated" water and sewer facilities system, which means that the system must be planned, programmed, developed, and operated to meet the needs of the entire area. Implementation of the individual projects in the program would occur through local governmental entities or, possibly, some form of special purpose regional government.

The HUD planning guidelines require that project priorities be established. Two general classifications of priority were used in this study: (1) projects that are remedial and are needed to correct obvious deficiencies and (2) projects that are needed or will be needed but can be deferred subject to availability of adequate financing. The estimated year of need is given where possible.

Approach to the Study

The method of approach to this study was dictated by funding and time constraints. Man-day output available within budget was apportioned among the four major topics: regional overview of the total water resources concept, water, sewerage, and drainage. However, because of the size and complexity of the planning area, discussion of the various utilities is presented by subregions or counties. Problems or solutions that overlap county boundaries are usually discussed under the first county mentioned. The scope of work included, as an order of first priority, the development of General Planning Objectives and Guidelines. An initial effort was directed to this end.

Concurrently with the objectives and guidelines development, a series of questionnaires was prepared for mailing to all the various water, sewerage, and drainage entities. Basic quantitative data regarding flows and extent of area served, projects planned in the short range, and general long-range plans were requested. As a part of the Phase I activity, numerous studies and reports had been obtained from various entities throughout ABAG counties and were made available. These were reviewed. In addition, several personal interviews with staff members of the larger entities were conducted.

In the development of the preliminary plan, an attempt was made to define the individual projects constituting the short-range programs as specifically as possible. However, the scope of work and the level of effort dictated by limited funding permitted no detailed studies of each individual area, and therefore detailed recommendations could not be made. The various local and subregional plans range from very general policy statements in some service areas to detailed engineering reports of several hundred pages in length in others. Almost 300 questionnaires were mailed out at the beginning of the study in the fall of 1970. Only about 80 percent of them were returned. Therefore, there are gaps and inconsistencies in the program and project listing which are unavoidable.

Data obtained from the reports, the questionnaires, and the interviews--considered in a regional aspect--are essentially the basis of the preliminary planning. However, the plan should in no way be considered fixed; there are numerous viable alternatives and a great deal of in-depth study is currently underway, particularly with regard to wastewater treatment and disposal. Therefore, it is obvious that many questions are unanswerable at this point in time. At most it can only be pointed out in the areawide preliminary plan what logically or feasibly could be done or considered. The projects in the program can include only those about which information was provided by the particular entities.

Because the tables that contain the data are lengthy, they are presented at the end of each chapter rather than intermingled with the text.

General Planning Objectives

Metropolitan water resource management involves "1) multiple purpose programs, 2) utilization of multiple means of implementation, 3) coordination of public and private management activities, 4) continual research to identify and analyze management opportunities and incorporate new technology, and 5) regional integration of management programs" [2]. Consistent with these requirements is the establishment of planning objectives and guidelines which can be used for program implementation and conceptualization. In fact, the initial step recommended in the report prepared for ABAG entitled "Phase I - Regional Water, Sewerage and Drainage Plan" [3] was to set forth objectives and guidelines. On the basis of an analysis of the pertinent factors and conditions within the study area, the following general objectives were selected for all of the plans (water, sewerage, and drainage).

1. Facilities in accordance with Regional Plan [4] adopted by ABAG.
2. Development of plans which:
   a. Are responsive to the needs of the area,
   b. Coordinate with related projects,

   - c. Consider the interrelationships within the total water resource system,
   - d. Achieve the desired result at the lowest possible cost consistent with environmental conditions, and
   - e. Have sufficient flexibility for continual updating of water resources planning.
3. Provision of service for all logical service areas.
4. Establishment of criteria which can be used in evaluating planning projects.

Special objectives and guidelines for the individual plans are given in Chapters 4, 5, and 6.

Estimates of Construction Costs

There are two primary sources of the cost estimates set forth in this report: (1) figures submitted by various entities in the returned questionnaires, and (2) estimates shown in the numerous engineering reports utilized in this compilation.

Unfortunately, there is no completely standardized method of relating the time factor to an estimate to allow for the continuing increase in cost. The best available barometer of these changes is the ENR (Engineering News-Record) Construction Cost Index. It is computed from prices of structural steel, portland cement, lumber, and common labor, and is based on a value of 100 in the year 1913. The ENR Index relationship has been used in this report to bring all cost estimates to end-of-year 1970. It was assumed that the estimates obtained from ABAG entities were as of the date of the report. Similarly, it was assumed that all estimates stated in the returned questionnaires were as of fall 1970. The San Francisco Average ENR Index at that time was 1580 and has been used for updating earlier estimates.

Chapter 2

SUMMARY AND CONCLUSIONS

The ultimate goal of regional urban planning is the enhancement of the quality of life for man. Because the presence or the lack of water in its various forms can be used to promote or control the activities of man it becomes imperative that the water resource of a region be managed properly to ensure optimum development.

The problems encountered in dealing with the total water resource (water supplies, wastewater, and drainage) of an area on a regional basis are complex because (1) water resource management is but one aspect of regional urban planning, an evolving field; (2) traditionally, water management has been handled on a local or localized subregional basis; and (3) the components that make up the water resource of an area are interrelated and must be considered in relation to each other. In the past years a great deal of water resource planning and construction has taken place throughout the nine-county Bay Area. Potable water has been transported many miles to provide man's needs in the region, many water and wastewater management facilities have been constructed, and numerous flood control and drainage structures have been built. Much remains to be done, however, particularly in the field of wastewater.

The principal purpose of this study was to (1) develop planning objectives and guidelines for each of the aforementioned water resource components and (2) recommend implementation programs as required to achieve regional management of this resource. Although they are interrelated, the summary conclusions derived from this study concerning each water resource component are for convenience presented separately in the following discussion.

Water

Fortunately the San Francisco Bay Area has had farsighted water planning. Indeed, without such planning the area could not have developed into the urban complex that it is today.

The important feature of the water supply situation is the historical assurance of annual replenishment of water sources in the Sierra Nevada mountains and the Russian River. Although the annual replenishment varies, the Bay Area as a whole can depend on an adequate supply for the next 20 years or longer. There are numerous deficiencies in transmission, storage, treatment, and distribution, and there are certain groundwater problems. Although there will be a need for new facilities as long as there is growth, it may be reasonably concluded that the Bay Area will not suffer from an overall shortage of water for the long-range period discussed in this report.

Wastewater

With respect to the total water resource and its relationship to the environment, the protection of receiving waters from man's wastewater has a priority of the highest order. To achieve this objective in the least amount of time, a short-range wastewater program is proposed for the bay system which would (1) utilize existing treatment facilities to the greatest extent possible, (2) transport wastewaters from the extremities of the estuarine system, (3) discharge to the deeper bay waters where greater assimilative capacity exists, and (4) upgrade treatment as required, either at existing plants or at effluent interceptor termini.

To determine the most desirable course of action for the complex and extensive bay region, it is proposed that there be established (1) some form of regional agency with implementation powers, and (2) a logical division of the entire region into several wastewater subregions. Each of these subregions would have a large share of the responsibility for developing the most desirable specific course of action to meet water quality objectives established by the State. Several such subregions have been established and in-depth studies are under way in some of them at this time.

Subject to modifications that the aforesaid in-depth studies will dictate, the short-term program for bayside areas consists, in general, of the construction of interceptor sewers to transport effluent to locations within the central bay between the San Mateo Bridge and the San Rafael-Richmond Bridge.

This short-term provision of effluent interceptors should be considered as a program that will result in the most immediate benefit to regional receiving waters in conjunction with the best use of available funding. It should not be considered as a goal to be reached. It is merely an initial step toward achieving the desired water quality objectives in the region and it must be followed by a continued upgrading of wastewater treatment. The importance of this first step, however, is not only that it will provide immediate improvement to the rivers and streams in the area and to the shallow extremities of the bay but that it will also provide an essential safeguard to future wastewater operations. The high assimilative capacity of the central bay will act as a buffer for any breakdown in treatment, accidental toxic discharge, or abnormal waste loads. This cushioning is not available in receiving waters of limited dilution capacity and such discharges can, and do at present, produce disastrous effects on the ecology of their outfall area.

Hopefully the recommended subregional interceptors will be rendered oversized in the future by the increased recycling of wastewater. However, they will never be rendered obsolete, for there will always be a need for the transport of unused and unusable wastewater to areas where it can be assimilated without detriment to the receiving area.

With continued advancement in the degree of treatment and the availability of receiving waters with a high self-purification potential, the region should be able, by responsible planning, to return the waters of the bay and rivers to a balanced state of ecological well-being.

It is likely that any long-range plan will be affected to a large degree by future technical developments. However, at this point in time the long-range plan is (1) to continue the improvement of treatment to meet future upgraded water quality standards, especially for increased removal of toxicity, nutrients, and specific constituents; (2) to achieve the greatest level of efficiency at the most economical level; and (3) to make maximum reclamation and reuse of wastewater.

It is expected that the major demand for wastewater recycling will continue to be at the local level for the period of this study. Advanced treatment for recycling should therefore be conducted at local facilities whether these are municipal or industrial. Unusable wastewater would be treated at either local or subregional plants.

Infiltration into sewerage systems (especially house connections) presents a very costly problem in treatment and disposal of wastewater. Therefore, a continuing effort must be directed toward minimizing sewer infiltration.

Drainage

A considerable amount of planning in the field of flood control and drainage has been performed throughout the Bay Area by local agencies and the federal government. The number of improved areas subject to periodic flooding has been substantially reduced. All area entities responsible for drainage have a reasonable estimate of their needs. Several cities have reported that their facilities are "fully developed" and they therefore have no short-range program or long-range plan.

There are a very large number of drainage projects planned and, in general, they will continue to be constructed on a priority basis subject to availability of funds. Unfortunately for those directly affected by flooding, priority for potable water and for proper wastewater treatment and discharge is usually higher. However, there will continue to be, through both the short and long range, a large annual expenditure for facility upgrading and replacement, and for channel lining, much of it not specifically determined at this time. One major item of annual cost which affects capital project budgets is that of siltation in channels. Until this can be controlled, there will continue to be need for dredging and for places to put the excavated material.

Storm drain flow (as differentiated from combined sewer flow in which there are human wastes) is generally considered relatively free of pollution. However, stormwater from urban areas can be highly contaminated, particularly during the "first flush" after a dry spell of any length. It is likely in the long range that at least such first flushes will require a measure of treatment to protect receiving waters.

Costs

The estimated total costs of short-range projects whose scope can be defined are listed in Table 1 (page 10). Remedial projects are those of the highest priority and are needed now to correct deficiencies. Other short-range projects are those needed in the next 5 to 10 years but their implementation depends upon the availability of funds.

Table 1

SUMMARY OF COSTS - SHORT-RANGE PROJECTS(1)

(Thousands of Dollars)

	Remedial Projects			
County	Water	Sewerage (Sewers)	Drainage	Total
Alameda	150	9,130	80	9,360
Contra Costa	324	3,363	7,632	11,319
Marin	--	2,250	1,650	3,900
Napa	664	447	7,000	8,111
San Francisco	--	12,000	4,000	16,000
San Mateo	4,750	3,616	20,874	29,240
Santa Clara	93	5,536	4,071	9,700
Solano	2,500	2,800	5	5,305
Sonoma	80	--	437	517
Total	8,561	39,142	45,749	93,452

	Other Short-Range Projects				
County	Water	Sewerage (Sewers)	Sewerage (Waste-water)(2)	Drainage	Total
Alameda	125,774	33,504	88,960	22,477	270,715
Contra Costa	132,807	3,750	31,580	250,805	418,942
Marin	25,262	4,373	10,635	26,485	66,755
Napa	7,600	3,135	2,330	--	13,065
San Francisco	152,041	1,000	65,050	--(3)	218,091
San Mateo	13,268	9,882	28,810	23,161	75,121
Santa Clara	96,983	14,595	53,965	57,823	223,366
Solano	3,229	2,117	10,240	3,980	19,566
Sonoma	46,340	5,318	15,680	991	68,329
Total	603,304	77,674	307,250	385,722	1,373,950

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(1) Tentative.
(2) Includes treatment and disposal.
(3) Combined Sewers--see Sewerage (sewers).

Chapter 3

THE REGIONAL PLAN

General Description of the Planning Area

The planning area of ABAG encompasses all of the nine counties which abut the San Francisco Bay estuarine system. They are Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Sonoma, and Solano (although Solano is not a member of ABAG). Data on the present and planned uses of land in the study area were developed by the ABAG staff and are set forth in the Bay Regional Plan [4]. Reference is made to that plan and its accompanying maps for specific information regarding the planning area. For the purposes of this report it is sufficient to say it is an area of world renown adjacent to the Pacific Ocean and greatly affected by the estuarine system comprised of Suisun Bay, San Pablo Bay, and San Francisco Bay. It is popularly known as the San Francisco Bay Area or simply the Bay Area. The Bay Regional Plan states:

> Its common shoreline unites the region, as does its economic influence, but its physical presence splits the 7,000 square mile area into a number of sub-regions. While providing excellent recreational opportunities and a pleasing visual aspect, the Bay creates problems in traveling from one part of the region to the other . . . . Whether focusing on the advantages it brings to the area or the problems it causes, the Bay's enormous impact on the entire region cannot be denied . . . . There are approximately 4.5 million acres of land in the nine county Bay Region, of which four million remain undeveloped. Of these four million acres, however, three million can be considered unsuitable for urban use because of physical limitations or constraints imposed by various restrictions . . . . In 1965, an estimated 344,000 acres had been developed for urban purposes. This constituted eight percent of the region's total land surface and 25 percent of the land with urbanizing potential, leaving 1.2 million

> acres available for future development. Seventy-six percent of the region's urban land in 1965 was devoted to residential use.

Approximately 80 percent of the region's total population of more than 4-1/2 million live in a belt of urban land encircling the bay, and 90 percent of the region's jobs are located within this belt.

General Description of the San Francisco Bay Regional Plan

The Bay Regional Plan summarizes the history of urban growth in the region and proposes a pattern for future growth. In the early stages of the development of the plan, five different regional development concepts were presented: City-Centered, Urban Corridor, Suburban Dispersal, Composite Local Plans, and a recommended Preliminary Regional Plan. Subsequently, after ABAG had conducted hearings and meetings regarding the plan, the City-Centered concept was adopted.

The development of the Regional Plan began in 1962, shortly after formation of ABAG by a joint powers agreement, parties to which were the numerous cities in the area and eight of the nine counties. The basic concept of the plan is:

> . . . to accommodate future urban growth within the region in existing or new urban communities . . . as currently defined, the concept . . . incorporates the following broad quantitative and qualitative objectives:
> 1. Identifiable concentrations of urban development around community centers.
> 2. Extensive open space and conserved areas.
> 3. Improved environmental quality.
> 4. A multiple-mode transportation system.
> 5. An operational regional organization.
> 6. Strong intergovernmental cooperation, coordination, and citizen participation.

It was acknowledged by the developers of the plan that its successful implementation must be predicated upon the validity of certain basic assumptions. For discussion purposes, the assumptions were divided into three general categories:

1. Growth and development
2. Environmental quality
3. Organization mechanisms

With respect to growth and development, it is assumed that the regional population will increase from 4.6 million to approximately 7.5 million in the next 20 years, and that more than three-fourths of this increase will locate in and around existing and new urban centers.

With respect to environmental quality, it is assumed that during the next two decades measures will continue to be instituted to halt the unnecessary use of limited natural resources and to replenish them whenever and wherever feasible.

With respect to organizational mechanisms, it is assumed that progress will be made in the development of effective regional organization. This appears to be essential if implementation of effective regional plans to improve the environment is to be realized.

Population Estimates

The most recent population projections available are those prepared in May 1969 by the BATSC (Bay Area Transportation Study Commission). Those projections were made after over two decades of rapid growth and nine years after the 1960 census.

Upon completion of the 1970 census it appeared that a downward revision of the projections was probably in order. However, as of this date no adjustment has been completed. Therefore the BATSC projections have been used and are shown in Table 2 (page 14).

Table 2

SAN FRANCISCO BAY REGION POPULATION, HISTORICAL AND PROJECTED, 1900-1990

	1900	1910	1920	1930	1940	1950	1960	1970[1]	1980[2]	1990[2]
Alameda	130,197	246,131	344,177	474,883	513,011	704,315	908,209	1,073,184	1,420,300	1,680,600
Contra Costa	18,046	31,674	53,889	78,608	100,450	298,984	409,030	558,389	821,700	1,080,000
Marin	15,702	25,114	27,342	41,648	52,907	85,619	146,820	206,038	307,600	408,700
Napa	16,451	19,800	20,678	22,897	28,503	46,603	65,890	79,140	103,700	139,800
San Francisco	342,782	416,912	506,676	634,394	634,536	775,357	740,316	715,674	806,700	826,600
San Mateo	12,094	26,585	36,781	77,405	111,782	235,659	444,387	556,234	737,600	872,500
Santa Clara	60,216	83,539	100,676	145,118	174,949	290,547	642,315	1,064,714	1,435,500	1,784,700
Solano	24,143	27,559	40,602	40,834	49,118	104,833	134,597	169,941	236,700	315,800
Sonoma	38,480	48,394	52,090	62,222	69,052	103,405	147,375	204,885	281,000	368,400
Bay Region	648,111	925,708	1,182,911	1,578,009	1,734,308	2,681,322	3,638,939	4,628,199	6,150,800	7,477,100

Sources:

1. U.S. Bureau of the Census 1900-1970.
2. Bay Area Transportation Study Commission, "Controlled Trends" Zonal Forecasts 1965-1980-1990, May 1, 1969, p. 15, 29 (may be revised downward due to 1970 census findings).

Chapter 4

WATER

The San Francisco Bay Area has grown in the past century primarily because of importation of water across city and county boundaries. Far-sighted municipal planning has led to the development of supplies in the Sierra Nevada Mountains up to 200 miles away from points of use. In addition, State and federal agencies have constructed and are constructing water supply and transmission facilities which will deliver water to and within the Bay Area to meet the needs of the foreseeable future. In this chapter recommended objectives and guidelines are presented, and the present water supply systems and the planned programs for meeting future water needs are reviewed briefly.

Planning Objectives and Guidelines

Objectives

1. Development of plans for water supplies of adequate quantity and quality for present and future use.
2. Development of a coordinated plan.
3. Multipurpose utilization of resources consistent with best sanitary practice.
4. Provision of domestic water systems that produce water conforming to the U.S. Public Health Service Drinking Water Standards.
5. Provision of water systems which meet the requirements of the American Insurance Association.

Guidelines

1. Provision of service in all urban areas.*

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* It is understood that the definition or extent of the urban areas shall be compatible with the intent of the HUD definition.

2. Provision for interagency cooperation in storage and emergency situations.
3. Provision of water treatment facilities capable of being used for at least 10 years without expansion.
4. Consideration of long-range use of California Water Plan water.
5. Relation of proposed plans to objectives.

Programs and Plans

For purposes of this report the water sources and systems are discussed on a subregional basis. These subregions are made up of county groupings as follows: (1) San Francisco-San Mateo-Santa Clara subregion, (2) Alameda-Contra Costa subregion, (3) Napa-Solano subregion, and (4) Sonoma-Marin subregion. These subregions have been chosen because of their geographical locations and because the counties in each subregion share at least one common water supply source. The water supply systems for the South Bay counties are shown in Figure 1 and those for the North Bay counties are shown in Figure 2. Population, water supply, and water use information is contained in Tables 3 through 11 at the end of this chapter (pages 33 through 47). All water for domestic purposes, except some well water, is chlorinated; therefore, chlorination is not listed as a treatment on the aforesaid tables. Areas serviced by the water distribution agencies are shown on Figure 3 (back pocket). Table 12 (page 48) contains the proposed projects which essentially constitute the short-range program.

San Francisco-San Mateo-Santa Clara Subregion

The counties of San Francisco, San Mateo, and Santa Clara are located to the west and south of San Francisco Bay, as shown on Figure 1. The subregion is highly urbanized except for the Pacific Coast area, mountainous areas, and the agricultural lands south of San Jose, and it is highly dependent on water imported from outside sources. Local sources, however, have also been developed. The Santa Clara Valley groundwater

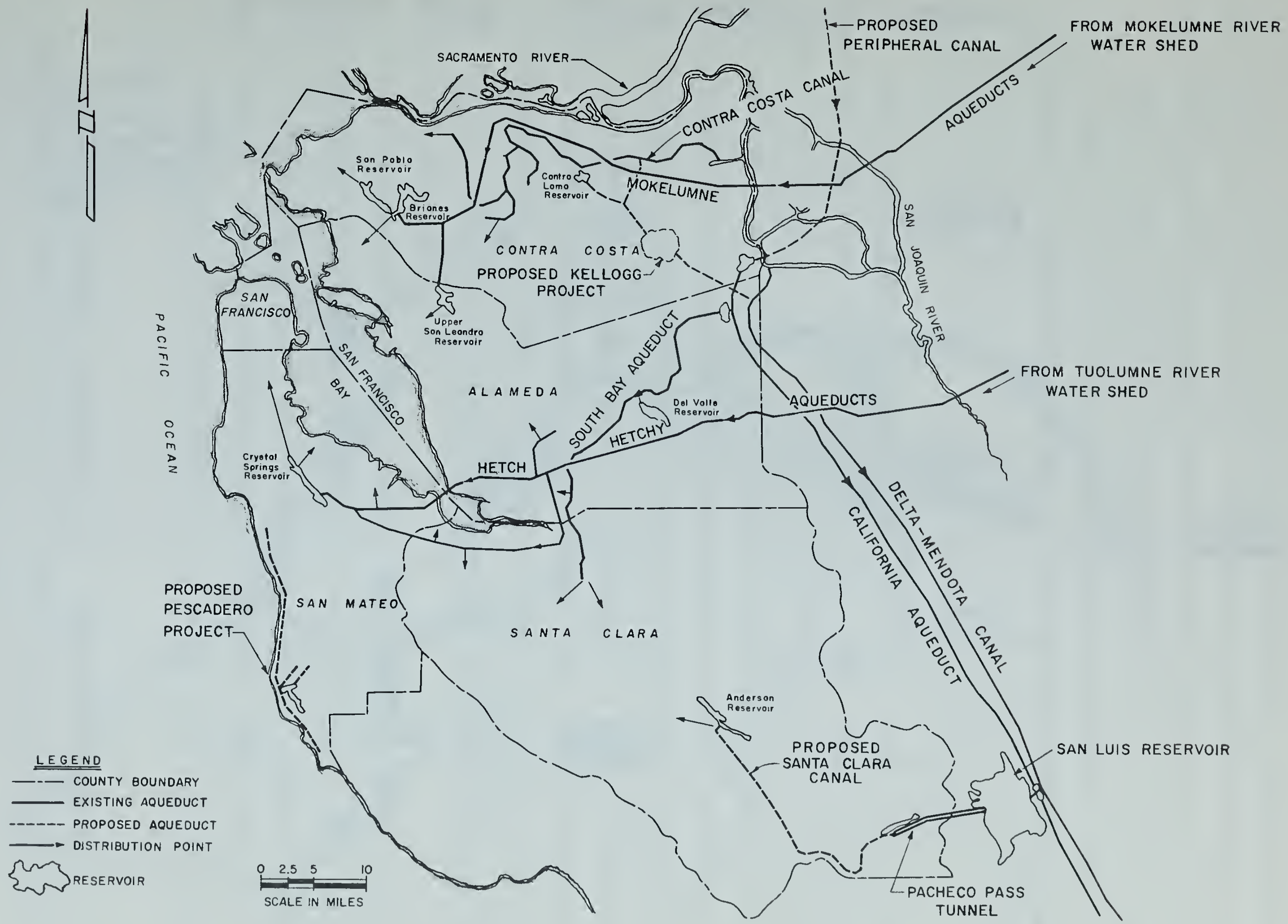

FIG. I WATER SUPPLY SYSTEMS - SOUTH BAY COUNTIES

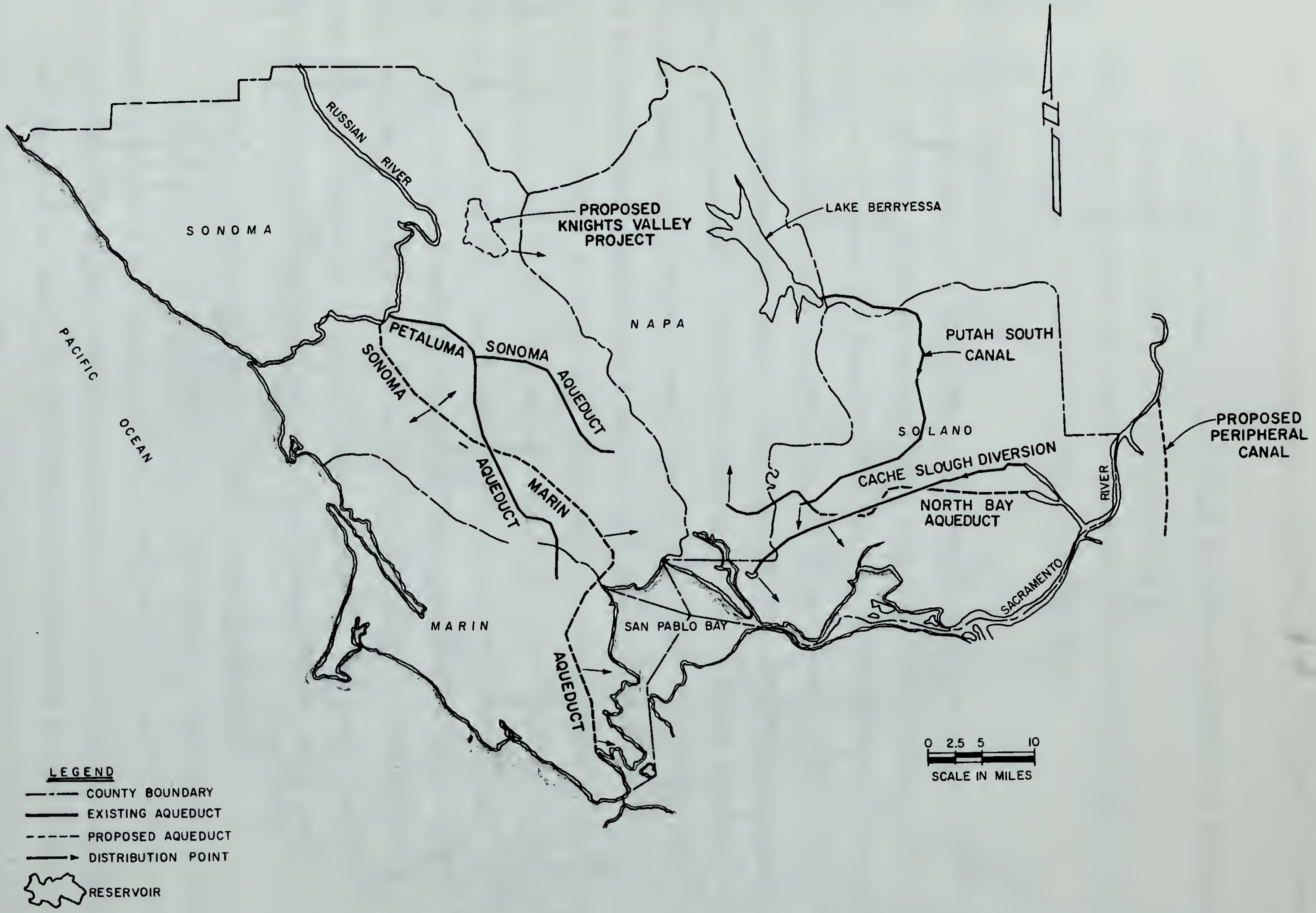

FIG.2 WATER SUPPLY SYSTEMS—NORTH BAY COUNTIES

basin has been extensively utilized and has experienced considerable overdraft conditions in several areas. Groundwater recharge facilities have been constructed to correct the overdraft and have been fairly successful.

Future water supplies for this subregion will be primarily imported surface supplies from the State Water Project and the USBR (U.S. Bureau of Reclamation) Central Valley Project. Current construction of the New Don Pedro Dam in the Sierra Nevada mountains by the San Francisco Water Department will also increase the water supply to the subregion.

Study and Management Needs. Because the primary sources of supply for this subregion are located outside the subregion, large transmission aqueducts and canals are necessary to conduct the water to the areas of use. These transmission facilities cross several active fault zones and are therefore vulnerable to earthquakes. Studies should be made to determine methods of increasing the reliability of these aqueducts through emergency interconnections. A disaster program should be developed to assure utilization of alternate supplies and emergency connections in the event of a major earthquake.

Considerable effort has been made in the management of groundwater in the Santa Clara Valley. This program should be continued to prevent overdraft of the basin.

There are many large water users in the subregion which are capable of reducing total water consumption through reuse of water. Per capita water use in the subregion has grown by about 1 percent annually for the past 20 years. Studies should be made to determine methods of water reuse and other means of water conservation by the water users to stabilize per capita use.

Population, Supply, and Water Use. The present population, supply, and water use information for the three counties is presented in Tables 3, 4, and 5 (pages 33, 34, and 37) by water purveyors.

San Francisco County. The City and County of San Francisco is served by the San Francisco Water Department. The primary source of supply is the Tuolumne River in the Sierra Nevada Mountains. This supply is supplemented by local sources in Alameda and San Mateo counties. The total firm yield from all supplies is 335 mgd (million gallons per day).

The San Francisco Water Department supplies water to essentially all of San Mateo County and to a large portion of Santa Clara county as well as to the City of Hayward in Alameda County. It is now constructing the New Don Pedro Dam on the Tuolumne River which, upon completion, will increase the total supply to 435 mgd. This supply should be adequate for the next 25 years or more.

San Mateo County. San Mateo County is served by a large number of small water districts, all of which purchase water from the San Francisco Water Department. Some of these districts also utilize local supplies; however, these supplies are insignificant on a countywide basis in comparison with the San Francisco supply. The only exception is the proposed Pescadero Creek project which would provide about 15 mgd to the coastside. Water supply from the San Francisco Water Department should be adequate to serve all purveyors in San Mateo County through 1990.

Santa Clara County. Santa Clara County is served by several major water agencies. These include the San Francisco Water Department, San Jose Water Works (an investor-owned utility), the Santa Clara County Flood Control and Water District, the South Santa Clara Valley Water Conservation District, and municipal water departments in most of the cities.

In general, the northern part of the county receives water from the San Francisco Water Department aqueducts and from some wells; the central county area receives water from wells, local reservoirs, and from the South Bay Aqueduct; the south county area receives water from wells and local reservoirs.

The Santa Clara County Flood Control and Water District is entitled to 100,000 acre-feet per year from the State Water Project's South Bay Aqueduct. When the USBR Pacheco Pass Aqueduct and Santa Clara Canal are completed, the District will be able to utilize an additional 210,000 acre-feet per year entitlement. These supplies, together with local surface and groundwater supplies, are expected to be adequate for about the next 50 years.

It is expected that the cities of Mountain View, Sunnyvale, Santa Clara, and Milpitas will be excluded from service by the San Francisco Water Department after 1980, when present contracts expire. These cities can then be supplied by the Santa Clara County Flood Control and Water District.

Short-Range Program. The following short-range water program is recommended for the San Francisco-San Mateo-Santa Clara subregion. Short-range projects planned by the various water supply agencies are given in Table 12 (page 48).

1. Subregion
    a. Construct additional aqueduct across San Joaquin Valley to increase total transmission capacity to 400 mgd from the Tuolumne River supply of the San Francisco Water Department system.

    b. Construct water treatment plant and treated water distribution system for northeast Santa Clara County.

    c. Construct raw water distribution facilities in Santa Clara County.
2. Urban areas
    a. Continue water service by local retail water districts with wholesale supply from San Francisco Water Department and Santa Clara County Flood Control and Water District.

    b. Expand distribution systems as needed.

c. Continue to utilize groundwater at rates less than known recharge rates.

Long-Range Plan. All of the major water supply agencies of this three-county subregion have long-range plans for water supply. These include facilities to utilize water supplies being developed as part of the State Water Project and the USBR Central Valley Project.

A growing interest has been shown in the past few years in reclamation of wastewater for additional water supply. Proposals have been submitted on methods of groundwater recharge using treated wastewater. Proposals in other parts of California have included methods of mixing treated wastewater with existing water sources in recreation and irrigation lakes which then become the source of raw water for treatment plants serving local areas. This method is basically the same as that now practiced throughout the country where rivers and streams are used both for water supply and wastewater disposal. Wastewater reclamation so far has met with sufficient resistance that it has not been utilized in these subregions. Its potential for use, however, is expected to become more attractive in the future.

Alameda-Contra Costa Subregion

Alameda and Contra Costa counties are located to the east of San Francisco Bay, as shown in Figure 1. The western part of the subregion is urban while the eastern part is primarily agricultural.

Water for these counties is supplied from the Sacramento-San Joaquin Delta through State Water Project and Contra Costa Canal aqueducts and canals, from local surface and groundwater sources, and imported from the Sierra Nevada mountains by the East Bay Municipal Utility District and the San Francisco Water Department.

Future water requirements can be met through planned expansion of the Sierra supplies and through development of the proposed Kellogg Unit of the

Central Valley Project. There is also considerable interest in wastewater reclamation for meeting future water needs.

Study and Management Needs. The use of groundwater in Alameda County has overdrawn the groundwater basin adjacent to and under South San Francisco Bay and has caused salt water intrusion into that basin. Aquifers within the basin are interconnected at different levels at the Hayward Fault. The fault, however, also acts as a barrier to lateral groundwater movement toward the bay. Groundwater pumping east of the fault has not lowered the water table below sea level. Pumping on the west or bayside of the fault, however, has lowered the water table to as much as 90 feet below sea level in the past 10 years. Pumpage west of the Hayward Fault is now being phased out as well development proceeds east of the fault.

Groundwater recharge has been practiced by the Alameda County Water District with fair success in the past several years. Continuing study and management is needed to prevent salt water intrusion east of the Hayward Fault. Additional recharge facilities may be needed because the natural recharge rate from Alameda Creek may have been altered by construction of Del Valle and San Antonio reservoirs.

Development of the Kellogg Unit of the Central Valley Project may not be completed soon enough to meet projected central Contra Costa County water needs. A pilot wastewater reclamation project is currently in operation in the county which may lead to an alternative source of supply for the area.

Population, Supply, and Water Use. The present population, supply, and water use information for each county is given in Tables 6 and 7 (pages 39 and 41).

Alameda County. The East Bay Municipal Utility District serves most of the major urban areas of western Alameda County and is the largest water agency in this two-county subregion. The District obtains its primary supply from the Mokelumne River watershed in Amador, Calaveras, and Alpine counties. Water is transported through the Mokelumne aqueducts to terminal reservoirs within the service area. These terminal reservoirs also collect additional supply from their individual local watersheds.

The present average rate of use is about 245 mgd and the District has water rights for a dependable yield of 335 mgd. This supply is estimated to be adequate to meet District needs for the next 20 years. The District is planning to augment its supply in the future from the USBR Auburn Dam Project on the American River. The proposed contract would permit an additional supply of 134 mgd and would increase the supply from all sources to 469 mgd.

The District's transmission capability was recently increased by the addition of the Third Mokelumne Aqueduct from 185 to 259 mgd. These transmission mains have an ultimate capacity of 330 mgd with additional pumping facilities.

The City of Hayward Municipal Water Department obtains its supply from the San Francisco Water Department through connections to the Bay Division Pipelines No. 1 and No. 2 five miles south of the city limits.

In the southwestern part of Alameda County water is supplied by the Alameda County Water District. The District has a contract with the State for a maximum of 42,000 acre-feet per year from the South Bay Aqueduct. Together with other sources, primarily groundwater, this should be sufficient to meet the District's total water needs until about 1990. At present, the District uses South Bay Aqueduct water only for recharge of the local groundwater basin. The groundwater basin is used for storage and purification of this water. The District plans to construct a filtration plant in the near future which will permit direct use of the aqueduct water. The District also purchases water from the San Francisco Hetch Hetchy aqueducts which run through the area.

The Alameda County Flood Control and Water Conservation District has water supply responsibility in its Zone 7, which covers the eastern half

Long-Range Plan. Long-range plans are being made by the major water supply agencies of the subregion. These include (1) supply to the East Bay Municipal Utility District from the USBR Auburn Dam-Folsom South Canal Project, (2) supply to the Contra Costa County Water District from the USBR Kellogg Unit of the Central Valley Project, and (3) supply from the State Water Project South Bay Aqueduct.

The long-range role of wastewater reclamation in Contra Costa County is under study at this time and a pilot project is in operation. Hopefully, the findings of the study will help in developing methods whereby a substantial fraction of the future potable water supply can be supplanted by reclaimed wastewater.

Napa Solano Subregion

Napa and Solano counties are located north of San Pablo Bay and the Sacramento River, as shown on Figure 2. Both counties are urbanized in the southern portions and agricultural elsewhere.

Water supplies for these counties are primarily surface supplies. These include several reservoirs in Napa County, the largest being Lake Berryessa, and diversion works on Cache Slough on the Sacramento River in Solano County. Groundwater has also been developed in both Napa and Solano counties.

Future additional water needs will be met through diversion from Lindsay Slough on the Sacramento River and transmission through the State Water Project North Bay Aqueduct. The maximum entitlement from the North Bay Aqueduct is 25,000 acre-feet per year from Napa County and 42,000 acre-feet per year for Solano County. The USBR Solano Project consists of Lake Berryessa within Napa County and the Putah South Canal in Solano County. The Solano County Flood Control and Water Conservation District has contracted for the entire firm yield of this system. The Putah Creek watershed area is in Napa County, however, and Napa has been granted certain water rights at Lake Berryessa which are expected to be adequate for anticipated local development.

Study and Management Needs. It is expected that additional water supplies will be needed in Napa County within 20 years. The Knight's Valley Project in Sonoma County has been considered, as has diversion of water from the Eel River into Lake Berryessa. Both projects are inactive at this time.

Agricultural water requirements are increasing rapidly in Solano County as pasture land is being converted to irrigated orchards and truck farms. Additional agricultural water sources will be necessary if this trend continues.

Population, Supply, and Water Use. Present populations of each water service area, together with sources of water supply and present water use are given in Tables 8 and 9 (pages 43 and 44).

Napa County. Napa County is served by several municipal water departments--the largest being the City of Napa--which have developed local surface and groundwater supplies. Reports indicate that the best reservoir sites in the county have now been developed and that further development would be uneconomical. Groundwater development is believed to be still possible although overdraft conditions have been experienced in some areas and groundwater quality has been found to be quite variable.

The Napa County Flood Control and Water Conservation District has contracted for water to be imported from the Sacramento River through the State Water Project North Bay Aqueduct. Until that project is completed, water will be supplied to southern Napa County from the USBR Solano Project at a point near Cordelia through the pipeline section of the North Bay Aqueduct which has been completed into Napa County.

Solano County. Solano County is served by several water agencies. The largest agency is the Vallejo Municipal Water Department which obtains its supply from Lake Curry in Napa County, from the Solano Project, and from the Cache Slough diversion. Other municipal departments and water districts are supplied primarily with Solano Project water administered by the Solano County Flood Control and Water Conservation District. North Bay Aqueduct water, when available, will also be administered by the District.

Short-Range Program. The following short-range water program is recommended for the Napa-Solano subregion, and short-range projects planned by the various water agencies are given in Table 12 (page 48).

1. Subregion
   a. Construct remaining portions of North Bay Aqueduct and Lindsay Slough diversion works.
   b. Construct transmission facilities as needed to utilize North Bay Aqueduct and Putah South Canal water.
2. Urban areas
   a. Construct filtration plants to assure adequate treatment of all surface supplies.
   b. Expand distribution systems as needed.
   c. Continue to utilize groundwater at rates not to exceed recharge rates.

Long-Range Plan. Long-range plans which have been previously made for serving the subregion include diversion of water from the Eel River into Lake Berryessa and importation from the Knight's Valley Project authorized by the Corps of Engineers in Sonoma County. Both of these projects are inactive at the present time.

Wastewater reclamation has a strong potential in this subregion for agricultural irrigation and ultimately for domestic use.

Sonoma-Marin Subregion

Sonoma and Marin counties border on the Pacific Ocean and the North Bay, as shown on Figure 2. The area is primarily rural except for several separate suburban communities and the city of Santa Rosa.

Present water supplies include local surface and groundwater development and diversion from the Russian River. Future water supplies will come largely through further development of the Russian River and from the U.S. Army Corps of Engineers Warm Springs Dam project now under construction on Dry Creek in Sonoma County, a tributary to the Russian River.

Study and Management Needs. The three major water agencies in the two-county subregion (referred to below) have recently completed the Russian River Water Plan which is expected to meet all needs for the foreseeable future. The plan is based on population and water use projections made prior to release of the 1970 census. The latest census figures indicate a slower-than-expected growth rate for the two counties; therefore, projections should be revised using the new data and project scheduling should be modified accordingly.

Population, Supply, and Water Use. Present populations of each water service area, together with sources of water supply and present water use, are given in Tables 10 and 11 (pages 45 and 47).

Sonoma County. The principal water agency in the county is the Sonoma County Water Agency, which administers water supplied from the Russian River and operates the present aqueduct system. The Agency plans to construct additional diversion works and the Sonoma-Marin Aqueduct in Sonoma County to deliver future supply from the Russian River throughout the county. Groundwater has also been utilized by local water districts.

Marin County. Two major water agencies serve Marin County. These are the North Marin County Water District and the Marin Municipal Water District. These districts distribute water transported from the Russian River and from reservoirs on local creeks in the county. The two agencies plan to meet future needs by constructing the Marin County facilities of the Russian River Water Plan. Groundwater has been utilized mainly for agricultural irrigation. Additional groundwater development is not believed to be economical.

Short-Range Program. The following short-range program is recommended for the Sonoma-Marin subregion. Short-range projects planned by the various water supply agencies are given in Table 12 (page 48).

1. Subregion
   a. Install additional large collector wells in the gravel beds of the Russian River as needed to supplement existing sources.
   b. Construct joint-use Sonoma-Marin Aqueduct to deliver Russian River Project water throughout Sonoma County and into Marin County.
   c. Russian River Project water should be developed jointly by Sonoma-Marin-and Mendocino county agencies as outlined in the Russian River Water Plan. Operation and maintenance of project facilities should also be a joint effort.
2. Urban and miscellaneous areas
   a. Additional water should be provided from the Russian River Project through local transmission mains connecting to the Sonoma-Marin Aqueduct.
   b. Distribution systems should be extended from the transmission mains to serve developing areas and service should be provided by local water districts.

Long-Range Plan. The three aforesaid major water agencies have conceived the Russian River Water Plan, which proposes development of additional water supply from the Russian River Basin and construction of an aqueduct system by which the two counties can be assured of firm supplies of water well into the twenty-first century. This plan is to be implemented between now and 1990. Continuing reassessment of population growth, per capita water consumption, industrial growth, and water reclamation potential may permit the utilization of this watershed supply for a greater number of years than originally planned.

Project Costs

The costs of remedial and short-range water supply projects have been listed in Table 1 (page 10).

Table 3

EXISTING WATER SUPPLY, SAN FRANCISCO COUNTY

Agency	Estimated Population 1970	Water Supply		Average Annual Consumption		
		Source	Treatment	mgd	% Municipal & Industrial	% Agricultural
San Francisco Water Department	1, 716, 100(1)	Surface supplies from Tuolomne, Alameda, Santa Clara, and San Mateo counties.	Filtration, fluoridation	240	100	0

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(1) This is the population of the total service area. The population served in the city and county of San Francisco is 754, 000.

Table 4

EXISTING WATER SUPPLY, SAN MATEO COUNTY

Agency	Estimated Population 1970	Water Supply		Average Annual Consumption		
		Source	Treatment	mgd	% Municipal & Industrial	% Agricultural
Belmont County Water District	24,000	SFWD		3.4	99.8	0.2
Brisbane Municipal Water District	2,800	SFWD			100	0
Broadmoor (California Water Service)		SFWD	Fluoridation	0.6	100	0
Burlingame Municipal Water District	28,600	SFWD		4.0	100	0
Coastside County Water District	7,700	SFWD		0.8	95	5
Daly City Municipal Water Department	65,500	Wells, SFWD		6.8	99	1
Dimond Public Utility District	4,000	SFWD				
East Palo Alto Water District	17,000	SFWD				

Table 4 (Continued)

Agency	Estimated Population 1970	Water Supply		Average Annual Consumption		
		Source	Treatment	mgd	% Municipal & Industrial	% Agricultural
Estero Municipal Improvement District	10,000	SFWD	Fluoridation	1.2	100	0
Hillsborough Municipal Water Department	8,228	SFWD		6.0 (max.)	100	0
Menlo Park Municipal Water Department	20,000	SFWD				
Menlo Park, Atherton, Woodside, Portola Valley (California Water Service)		Wells, SFWD		10.1	100	0
Millbrae Municipal Water Department	22,000	SFWD		2.9	99	1
North Coast County Water District	36,000	SFWD, surface supply	Filtration, fluoridation	3.4	100	0
Redwood City Municipal Water Department and Redwood Shores	64,000	SFWD		8.8	99	1

Table 4 (Continued)

Agency	Estimated Population 1970	Water Supply		Average Annual Consumption		
		Source	Treatment	mgd	% Municipal & Industrial	% Agricultural
San Bruno Municipal Water Department	39,000	SFWD		4.1	100	0
San Carlos (California Water Service)		SFWD		4.2	100	0
San Mateo (California Water Service)		SFWD	Fluoridation	11.8	100	0
Skyline County Water District	1,400	SFWD		0.1	100	0
South San Francisco (California Water Service)		SFWD	Fluoridation	7.9	100	0
Westborough County Water District	4,500	SFWD		0.1	100	0

Table 5

EXISTING WATER SUPPLY, SANTA CLARA COUNTY

Agency	Estimated Population 1970	Water Supply		Average Annual Consumption		
		Source	Treatment	mgd	% Municipal & Industrial	% Agricultural
Cupertino Municipal Water Department	10,000	Wells, treated water from Santa Clara County FCD, creeks	By Santa Clara County FCD	2.1	63	37
Gilroy Municipal Water Department	12,699	Wells	None	0.9	100	0
Los Altos (California Water Service)		Wells	Filtration	9.7	100	0
Milpitas Municipal Water Department	27,710	SFWD		4.5	100	0
Morgan Hill Municipal Water Department	5,500	Wells	Fluoridation	0.8	100	0
Mountain View Municipal Water Department	53,000	SFWD, Wells		9.5	99	1
Palo Alto Municipal Water Department	58,623	SFWD	Fluoridation	15.6	100	0

Table 5 (Continued)

Agency	Estimated Population 1970	Water Supply		Average Annual Consumption		
		Source	Treatment	mgd	% Municipal & Industrial	% Agricultural
Purissima Hills County Water District	4,800	SFWD		1.0	99	1
San Jose Municipal Water System						
North San Jose Service Area	1,300	Well, SFWD		0.1	100	0
Evergreen Service Area	11,200	Wells, San Jose Water Works	Fluoridation	1.8	99	1
Santa Clara Municipal Water Department	85,500	Wells, Santa Clara County FCD		13.3	100	0
Santa Clara County Flood Control and Water Conservation District	1,057,000	Groundwater, surface water, South Bay Aqueduct	Filtration	170	82	18
Sunnyvale Municipal Water Department	101,000	SFWD, wells, Santa Clara County FCD		17.5	99	1
San Jose Water Works				35		

Table 6

EXISTING WATER SUPPLY, ALAMEDA COUNTY

		Water Supply		Average Annual Consumption		
Agency	Estimated Population 1970	Source	Treatment	mgd	% Municipal & Industrial	% Agricultural
Alameda County Flood Control and Water Conservation District	79,400	South Bay Aqueduct, wells	Filtration	6.2	90	10
Alameda County Water District	131,000	South Bay Aqueduct, SFWD, wells	Filtration, iron and manganese removal, softening	19.5	67	33
East Bay Municipal Utility District	1,450,000	Surface supplies from Amador, Calaveras, Alpine, Alameda, and Contra Costa counties.	Filtration	245	100	0
Hayward Municipal Water Department		SFWD	Filtration, fluoridation	12.8	98	2
Livermore Municipal Water Department	35,500	Alameda County FCD No. 7, well	Filtration, fluoridation	0.5	98	2

Table 6 (Continued)

Agency	Estimated Population 1970	Water Supply		Average Annual Consumption		
		Source	Treatment	mgd	% Municipal & Industrial	% Agricultural
Livermore (California Water Service)		Alameda County FCD No. 7	Filtration	5.1	100	0
Pleasanton Municipal Water Department	20,000	Wells	Fluoridation	2.0	100	0
Valley Community Services District	15,500	Wells	Iron and manganese removal	2.0	100	0

Table 7

EXISTING WATER SUPPLY, CONTRA COSTA COUNTY

Agency	Estimated Population 1970	Water Supply		Average Annual Consumption		
		Source	Treatment	mgd	% Municipal & Industrial	% Agricultural
Antioch Municipal Water Department	28,200	USBR, Delta	Filtration, fluoridation	4.5	100	0
Brentwood Municipal Water Department						
Contra Costa County Water District						
Water Supply Division	260,000	USBR, Delta	None	66	94	6
Treated Water Division	130,000	USBR, Delta	Filtration, fluoridation	19.3	100	0
Gregory Gardens Water System	6,500	USBR	Filtration, fluoridation	1.0	100	0
Martinez Municipal Water Department	23,000	USBR, Delta	Filtration, fluoridation	3.8	100	0

Table 7 (Continued)

Agency	Estimated Population 1970	Water Supply		Average Annual Consumption		
		Source	Treatment	mgd	% Municipal & Industrial	% Agricultural
Oakley County Water District	3,000	USBR, Delta	Filtration	0.5		
Pittsburg Municipal Water District	21,100	USBR, Delta	Filtration, fluoridation	3.5	100	0

Table 8

EXISTING WATER SUPPLY, NAPA COUNTY

Agency	Estimated Population 1970	Water Supply		Average Annual Consumption		
		Source	Treatment	mgd	% Municipal & Industrial	% Agricultural
American Canyon Water Department	5,000	Surface supply, North Bay Aqueduct	Filtration	1.0	100	0
Calistoga Municipal Water Department	2,200	Surface supply, wells	Filtration, iron and manganese removal	0.4		
Circle Oaks County Water District						
Napa Municipal Water Department	45,571	Surface supply, North Bay Aqueduct	Filtration	9.9	100	0
St. Helena Municipal Water District						
Yountville Municipal Water Department						

Table 9

EXISTING WATER SUPPLY, SOLANO COUNTY

Agency	Estimated Population 1970	Water Supply		Average Annual Consumption		
		Source	Treatment	mgd	% Municipal & Industrial	% Agricultural
Benicia Municipal Water Department	7,000	Solano Project	Filtration	5.5	100	0
City of Fairfield	32,000	Solano Project	Filtration, fluoridation	4.7	100	0
Rio Vista Municipal Water Department						
Solano County Flood Control and Water Conservation District	3,880	Solano Project, wells, reuse of drainage water	None		14	86
Suisun Municipal Water Department	4,000	Solano Project, wells	Filtration	0.5	99.5	0.5
Vacaville Municipal Water Department	22,250	Solano Irrigation District, wells	Filtration	3.6	100	0
Vallejo Municipal Water Department	119,000	Surface supply, Delta, Solano Project	Filtration, fluoridation	22	100	0

Table 10

EXISTING WATER SUPPLY, SONOMA COUNTY

Agency	Estimated Population 1970	Water Supply		Average Annual Consumption		
		Source	Treatment	mgd	% Municipal & Industrial	% Agricultural
Bodega Bay Public Utility District	700	Wells, surface supply	Iron and manganese removal, filtration	0.1	100	0
Cloverdale Municipal Water Department						
Cotati Municipal Water Department						
Healdsburg Municipal Water Department	5,500	Wells	Fluoridation	1.9	100	0
Petaluma Municipal Water Department	25,000	Sonoma County Water Agency, wells, surface supply	Filtration	3.4		
Rohnert Park Municipal Water District	6,300	Wells, Coyote Aqueduct for peaks	None	1.0	95	5

Table 10 (Continued)

Agency	Estimated Population 1970	Water Supply		Average Annual Consumption		
		Source	Treatment	mgd	% Municipal & Industrial	% Agricultural
Santa Rosa Municipal Water Department	75,000	Sonoma County Water Agency		11.0	100	0
Sebastopol Municipal Water Department	4,000	Well	Chlorination	1.0	100	0
Sonoma Municipal Water Department	4,100	Sonoma County Water Agency		0.9	100	0
Sonoma County Water Agency (1)	200,000	Russian River radial collectors	Natural filtration chlorination	17.5	99	1
Valley of the Moon County Water District	15,100	Sonoma County Water Agency, wells		1.2	100	0

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(1) Serves cities and districts in Sonoma and Marin counties. Population and consumption also shown in listing of those particular entities.

Table 11

EXISTING WATER SUPPLY, MARIN COUNTY

Agency	Estimated Population 1970	Water Supply		Average Annual Consumption		
		Source	Treatment	mgd	% Municipal & Industrial	% Agricultural
Bolinas Community Public Utility District	1,200	Surface supply		0.1	99.6	.4
Bolinas Beach Public Utilities District						
Marin Municipal Water District	160,000	Surface supply	Filtration	29.0	95	5
North Marin County Water District	35,000	Sonoma County Water Agency, surface supply	Filtration, iron and manganese removal	5.3	100	0

Table 12

SHORT-RANGE WATER SUPPLY PROJECTS

Agency	Description of Project	Capital Cost Estimate
Alameda County		
Alameda County Flood Control and Water Conservation District	1971 - Groundwater recharge facilities.	$ 110,000
	1971 - Water transmission pipelines.	2,215,000
	1971 - Water treatment plant.	2,064,000
	1972 - Treated water reservoir.	390,000
	1972 - Groundwater recharge facilities.	286,000
	1973 - Streamgaging stations.	43,000
	1974 - Expansion of water treatment plant.	1,490,000
	1975 - Water transmission pipeline.	250,000
	1978 - Well water pumping stations.	365,000
	1978 - Water transmission pipeline.	1,250,000
Alameda County Water District	1970-75 - Expansion of distribution system.	2,540,000
	1970-80 - 50 million gallon reservoir construction.	6,000,000
	1970-75 - Wells and softening facilities.	1,000,000
	1970-75 - Distribution pipeline replacement.	150,000*
	1972 - 10-mgd water filter plant.	1,500,000
	1972-73 - Fabridam in Alameda Creek flood control channel.	300,000

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* Remedial project.

Table 12 (Continued)

Agency	Description of Project	Capital Cost Estimate
Alameda County		
	1975-80 - Pit T diversion facility.	$ 100,000
	1975-80 - Groundwater salinity intrusion barrier.	1,000,000
	1976-80 - Expansion of distribution system.	1,500,000
Hayward Municipal Water Department	None.	
Livermore Municipal Water Department	1970-71 - Water lines and reservoir.	103,000
	1971-72 - Same as above.	310,000
	1972-73 - Same as above.	152,000
	1973-74 - Same as above.	62,000
	1974-75 - Same as above.	100,500
	1975-76 - Same as above.	45,000
	1976-77 - Same as above.	400,000
Pleasanton Municipal Water Department	1970-71 - Expansion of distribution system.	825,000
	1971-72 - Same as above.	182,000
	1972-73 - Same as above.	184,000
	1973-74 - Same as above.	563,000
	1974-75 - Same as above.	220,000
Valley Community Services District	1971 - One new well.	30,000
	1973 - One new storage reservoir.	250,000

Table 12 (Continued)

Agency	Description of Project	Capital Cost Estimate
Alameda County		
East Bay Municipal Utility District	1971-75 - Raw water, storage, transmission and pumping.	$ 13,332,000
	1971-75 - Filtration facilities.	3,294,000
	1971-75 - Distribution system.	32,649,000
	1971-75 - Other facilities.	670,000
	1971-80 - Distribution facilities.	50,000,000
Contra Costa County		
Antioch Municipal Water Department	1972 - Pumping station and storage.	364,000
Brentwood Municipal Water Department	NIR.(1)	
Contra Costa County Water District		
Water Supply Division	By USBR:	
	1970 - Four 100-cfs pumping units.	500,000
	1971 - 5-mile 48-inch pipeline.	4,500,000
	1975 - 105,000 acre-ft dams and reservoir.	31,600,000
	By District:	
	1972 - 3 miles of new canal, 1,000 cfs.	5,400,000
	1972 - 8,500 acre-ft forebay.	4,900,000
	1972 - 26-mile pipeline, 11-1/2 ft to 8 ft ID.	63,000,000
	1972 - 1.7 miles of miscellaneous pipelines, 30-inch - 6-inch.	8,500,000

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(1) No information received.

Table 12 (Continued)

Agency	Description of Project	Capital Cost Estimate
Contra Costa County		
Treated Water Division	1971 - Enlarge Mallard Reservoir.	$ 1,500,000
	1971 - Miscellaneous distribution, storage and pumping.	2,000,000
	1972 - Same as above.	1,800,000
	1973 - Same as above.	1,100,000
	1974 - Same as above.	1,200,000
	1975-80 - Same as above.	1,200,000/yr
Gregory Gardens Water System	None.	
Martinez Municipal Water Department	1970 - Replace 12-inch water main - Main Street.	47,000*
	1971 - Annual water main replacement program (small mains).	42,000*
	1971 - 8-inch main extension - Virginia Hills Drive.	33,500
	1971 - Repair Hillside Reservoir.	10,000*
	1972 - Annual water main replacement program.	25,000*
	1973 - Same as above.	25,000*
	1973 - F St. main installation - Estudillo to Alhambra.	25,000
	1973 - Install 8-inch main - Francis Drive.	42,000
	1974 - Annual water main replacement program.	25,000*

Table 12 (Continued)

Agency	Description of Project	Capital Cost Estimate
Contra Costa County		
	1974 - Install 12-inch main - Vine Hill Way.	$ 75,000
	1974 - Install 12-inch main - Alhambra Ave. (F St. to Arch).	50,000
	1975 - Annual water main replacement program.	25,000*
	1975 - Install parallel 20-inch main - Howe Road.	200,000
	1975 - Install third pump - Howe Road pumping station.	18,000
	1975-80 - Annual replacement program.	125,000*
Pittsburg Municipal Water District	None.	
Oakley County Water District	NIR.	
Marin County		
Bolinas Community Public Utility District	1970-72 - Purchase of 106 acres Pine Gulch Creek.	106,000
	1971-72 - Filtration plant.	15,000
	1971-72 - Storage tank.	42,000
	1971-80 - Construction of dam.	Undetermined
Bolinas Beach Public Utilities District	NIR.	
Marin Municipal Water District	1970-1980 - Transmission and distribution improvement and expansion.	20,000,000
	Reservoir improvement.	1,500,000

Table 12 (Continued)

Agency	Description of Project	Capital Cost Estimate
Marin County		
North Marin County Water District	1971 - Water supply, Point Reyes area.	$ 168,000
	1973 - Phase I, Sonoma-Marin Aqueduct - North Marin County Water District share.	2,500,000 (est. 1969)
	1979 - Phase II, Sonoma-Marin Aqueduct and Section I, Marin Aqueduct.	931,000
Napa County		
American Canyon Water Department	1973 - Replace old lines, construct reservoir.	1,000,000
Calistoga Municipal Water Department	1970-71 - Well and treatment plant expansion.	25,000
	1970-75 - Replacement of water mains (priority A).	207,550*
	1975-80 - Replacement of water mains (priority B).	206,850*
	1970-80 - New storage reservoir.	125,000
Napa Municipal Water Department	1971 - Replacement of transmission facilities.	250,000*
	1972 - Expansion of transmission facilities.	350,000
	1973 - Additional storage facilities.	250,000
	1974 - New distribution expansion.	150,000
	1975 - Treatment facilities at Milliken Dam.	1,000,000
	1976 - Temporary treatment facilities at Conn Dam.	2,500,000

Table 12 (Continued)

Agency	Description of Project	Capital Cost Estimate
Napa County		
	1976 - Expansion of existing treatment plant.	$ 2,000,000
	1978 - Additional distribution facilities.	200,000
St. Helena Municipal Water District	NIR.	
Yountville Municipal Water Department	NIR.	
San Francisco County		
San Francisco Water Department	1970-80 - Continuing improvement programs.	60,985,000
	1970-80 - Major system improvements.	65,056,000
	1978 - Increase capacity of Hetch Hetchy Aqueduct - 47.5-mile pipeline across San Joaquin Valley.	26,000,000
San Mateo County		
Belmont County Water District	1971-72 - Pump station and connecting main.	600,000
Brisbane Municipal Water District	1972 - Replacement of mains in central Brisbane.	500,000*
	1976 - Tanks, pumps, etc.	150,000
Burlingame Municipal Water Department	1970-78 - Repair and replace distribution mains.	100,000/yr*

Table 12 (Continued)

Agency	Description of Project	Capital Cost Estimate
San Mateo County		
Coastside County Water District	1971 - Denniston Creek project.	$ 700,000
	1973 - Crystal Springs pump station and transmission line.	2,500,000
	1973 - Crystal Springs treatment plant.	1,000,000
	1975 - Transmission and storage facilities.	1,000,000
Daly City Municipal Water Department	1970 - Replacement and betterment, as required.	20,000 to 50,000*
	1971 - 10.0 million gallon reservoir - Reservoir 5B.	1,000,000
Dimond Public Utility District	NIR.	
East Palo Alto Water District	NIR.	
Estero Municipal Improvement District	1973 - 4 million gallon reservoir and two booster pumps.	430,000
	1975 - Connection with Redwood City water system for backup supply.	75,000
	1978 - Water distribution system for approximately 125 acres of industrial park.	250,000
Hillsborough Municipal Water Department	NIR.	
Menlo Park Municipal Water Department	NIR.	

Table 12 (Continued)

Agency	Description of Project	Capital Cost Estimate
San Mateo County		
Millbrae Municipal Water Department	1970 - Millbrae Meadows pressure system.	$ 100,000
	1970 - Geraldine Drive pump station.	25,000
	1970 - Water mains construction.	47,000
	1971 - Same as above.	45,000
	1971 - 8-inch meter at Capuchino High School.	1,500
North Coast County Water District	1970-71 - 10 million gallon storage and pipelines.	1,295,000
	1973-74 - Same as above.	1,295,000
	1976-77 - Parallel 24-inch transmission line.	600,000
	1980 - 10 million gallon storage and pipelines.	1,295,000
Palo Alto Park Mutual Water	NIR.	
Redwood City Municipal Water Department	1971 - Remedial/replacements water mains, services and fire hydrants - Friendly Acres service area.	400,000*
	1972 - Remedial/replacements water mains, services and fire hydrants - Emerald Lake service area.	500,000*
	1971-80 - Remedial/replacements water mains, services and fire hydrants - Metropolitan service area.	1,000,000*
	1976 - Reservoir rehabilitation program - Metropolitan service area.	1,500,000*
	1976 - New 4 million gallon reservoir and pumping station - Metropolitan service area.	700,000

Table 12 (Continued)

Agency	Description of Project	Capital Cost Estimate
San Mateo County		
San Bruno Municipal Water Department	NIR.	$
Skyline County Water District	Funds not available for present need for additional storage facilities.	
Westborough County Water District	1970 - Transmission line.	100,000
	1971 - Intertie Daly City.	10,000
	1971 - Supply line to Christen Hill Reservoir.	50,000
	1975 - Intertie to San Bruno.	Indeterminate
	1973 - 500,000-gallon additional storage.	Indeterminate
Santa Clara County		
Cupertino Municipal Water Department	1970 - Mann Station Connection.	2,500
	1971 - Montebello loop.	18,000
	1971 - District loop improvement.	4,000
	1972 - Replacement of transmission lines.	25,000*
	1973 - Replacement of obsolete lines.	68,000*
	1974 - Construction of new pump station.	30,000
	1974 - Stevens Creek transmission and distribution lines.	155,000
	1975 - New distribution line.	85,000
	Depends on demand - construction of second 2 million gallon tank.	100,000

Table 12 (Continued)

Agency	Description of Project	Capital Cost Estimate
Santa Clara County		
Gilroy Municipal Water Department	1971 - South Chestnut St. transmission main.	$ 30,000
	1973 - Church St. loop.	25,000
	1971-80 - Distribution improvements.	50,000
Milpitas Municipal Water Department	1970-80 - Expansion of the distribution system.	6,000,000
	1975 - Reservoir, 4 million gallon.	450,000
Morgan Hill Municipal Water Department	1971 - Trunk lines and reservoir.	80,000
	1972 - Same as above.	150,000
	1973 - Same as above.	250,000
	1974 - Same as above.	500,000
Mountain View Municipal Water Department	1970-74 - Distribution system improvements.	600,000
	1974-80 - Same as above.	1,100,000
Palo Alto Municipal Water Department	1971-72 - Mains, services, hydrants, production equipment.	195,400
	1972-73 - Same as above.	217,100
	1973-74 - Same as above.	177,350
	1974-75 - Same as above.	213,500
	1975-76 - Same as above and storage.	415,600
Purissima Hills County Water District	1972 - 100-hp pump, storage.	150,000
	1972-1980 - Transmission mains, storage capacity, possible wells or stream development.	500,000

Table 12 (Continued)

Agency	Description of Project	Capital Cost Estimate
Santa Clara County		
San Jose Municipal Water System		
North San Jose Service Area	1970 - North San Jose water transmission main - Unit 2.	$ 200,000
	1971 - Los Esteros Main - Unit 1.	50,000
	1972 - Route 237 Main - Unit 1.	40,000
	1973 - Route 237 Main - Unit 2 - Zanker Road Main - Unit 1.	40,000
	1974 - Los Esteros Road Main - Unit 2 - Zanker Road - Unit 2.	50,000
Evergreen Service Area	1974 - Connection to Santa Clara County Flood Control and Water District treated water supply.	Indeterminate
Santa Clara Municipal Water Department	1970-80 - Buildings and grounds.	135,000
	1970-80 - Service and development extensions.	1,500,000
	1970-80 - Distribution expansion and improvements.	1,283,000
	1970-80 - Wells and pumps.	583,000
	1971 - Supervisory control expansion.	50,000
	1972 - Transmission main - Central.	250,000
	1974 - Storage facility - downtown.	1,000,000
	1975 - Storage facility - North.	400,000
	1976 - Transmission main - North.	250,000

Table 12 (Continued)

Agency	Description of Project	Capital Cost Estimate
Santa Clara County		
Santa Clara County Flood Control and Water Conservation District	1972 - Relocate Coyote Dam spillway.	$ 2,000,000
	1973 - Treated water pipeline to Evergreen area.	5,750,000
	1973 - Treated water turnout to Mountain View.	260,000
	1974 - Enlargement of Calero Dam and Reservoir.	16,913,000
	1976 - Extension of raw water distribution system.	16,000,000
	1976 - Irrigation system for South County.	17,000,000
	1978 - Water treatment plant - eastside North County.	6,100,000
	1978 - Treated water distribution system for eastside plant.	14,200,000
Sunnyvale Municipal Water Department	1970-1976 - Enlarge and extend major transmission mains in the southern half of city.	1,430,945
San Jose Water Works	NIR. A stockholder-owned public utility.	
Solano County		
Benicia Municipal Water Department	1970-80 - Water from Solano Project of Solano County Flood Control and Water Conservation District (Lake Berryessa).	Indeterminate
Fairfield	1975 - Phase I, extend water mains.	454,000

Table 12 (Continued)

Agency	Description of Project	Capital Cost Estimate
Solano County		
Rio Vista Municipal Water Department	NIR.	$
Solano County Flood Control and Water Conservation District	1971 - Rehabilitation of Putah South Canal.	100,000*
	1972 - Same as above.	150,000*
	1973 - Same as above.	250,000*
Solano Irrigation District	1971 - Rehabilitation and betterment.	475,000*
	1972 - Same as above.	520,000*
	1973 - Same as above.	400,000*
	1974 - Same as above.	439,000*
	1975 - Same as above.	166,000*
Suisun Municipal Water Department	1971 - Twin Sister distribution system.	80,000
	1971 - Locke Padden distribution system.	20,000
	1980 - Lawler distribution extension.	100,000
Vallejo Municipal Water Department	1971-76 - Transmission, distribution, pumping and storage facilities.	2,500,000
Vacaville Municipal Water Department	1975 - 12-inch water main to northerly city limits (for future expansion).	75,000
Sonoma County		
Bodega Bay Public Utilities District	1970 - System improvements.	50,000
	1975 - Same as above.	137,000
	1980 - Finley Creek Dam.	500,000
Cloverdale Municipal Water Department	NIR.	

Table 12 (Continued)

Agency	Description of Project	Capital Cost Estimate
Sonoma County		
Cotati Municipal Water Department	1972 - Replacement and updating system.	$ 80,000*
	1974 - Additions to system.	15,000
	1978 - Same as above.	25,000
	1980 - Same as above.	30,000
Healdsburg Municipal Water Department	1970-71 - Well, pressure tank, chlorination and fluoridation.	25,000
	1971-73 - Three wells.	35,000
Petaluma Municipal Water Department	1971 - 2 million gallon reservoir.	150,000
	1971 - Pump station.	30,000
	1971-80 - Distribution system improvements.	2,000,000
Rohnert Park Municipal Water District	1971 - New well and 300,000-gallon tank.	120,000
	1972 - New well and 15,000-gallon tank.	60,000
	1974 - Same as above.	60,000
	1976 - New well and 300,000-gallon tank.	120,000
	1978 - New well and 15,000-gallon tank.	60,000
	1980 - Same as above.	60,000
Santa Rosa Municipal Water Department	1971-75 - Water mains, West Santa Rosa, North from Hwy. 12 to Hwy. 101 (Phase 1).	342,700
	1975-80 - Water mains, South City limits to Millbrae Ave. (Phase 1).	453,000

Table 12 (Continued)

Agency	Description of Project	Capital Cost Estimate
Sonoma County		
Sebastopol Municipal Water Department	None.	$
Sonoma Municipal Water Department	Storage and trunk line	Indeterminate
Sonoma County Water Agency	1970-80 - Supplemental facilities.	12,617,000
	1970-80 - Sonoma-Marin Aqueduct (including both Sonoma and Marin County costs).	29,450,000
Valley of the Moon County Water District	None.	

Chapter 5

SEWERAGE

Of the three components that constitute the total water resource, wastewater is perhaps the most difficult one with which to deal creatively from a management standpoint in a regional framework. The reason for this is that urban regional planning, of which wastewater management is a component, is an emerging field. The final direction in which programs should go is unknown and of necessity must evolve as additional experience is gained. The main purpose of this section is, therefore, to outline the recommended short-range programs and long-range conceptual plans for the management of wastewater within the Bay Area.

Background

The purpose and scope of the sewerage study, a brief review of present and future studies, and the general philosophy governing the conduct of this aspect of the overall study are discussed in this section. This background material is fundamental to an understanding of the development of the proposed programs and plans.

Purpose and Scope of Sewerage Study

As previously emphasized in Chapter 1, the scope of this study was necessarily limited in its depth. No new investigative work could be undertaken and the results of the study, therefore, rely heavily on data previously accumulated, on reports to individual agencies, on the State's Bay-Delta Report, and on the questionnaires from, and interviews with, various organizations concerned with wastewater disposal.

The intent of this phase of the study is to provide ABAG with a tool which can be used in the future as a base for both its areawide planning function and its role as the responsible authority in the region for the HUD Water and Sewer Facilities Grant Program. Much more investigative work needs to be done, and is being done at present, before a final, viable plan can be formulated for the area. The wastewater disposal program presented herein is therefore a flexible base upon which to build and upon which to add the results of the studies and investigations presently underway. Its guiding concept has been to ensure the greatest possible benefit to the waters of the region in relation to the amount of money available at any one time. Initial allocations of funds for the transport of effluents to more acceptable discharge points, for the consolidation of outfalls to deep water areas, and for subregional final treatment where necessary, would appear to offer the greatest immediate benefit to the area as a whole. Continued use of existing plants in the initial years with effluent transport to better discharge areas followed by a programmed phase-out of the more inefficient plants into consolidated facilities would seem to ensure the most beneficial use of available funds.

Present and Future Studies

Major subregional or countywide sewerage and water quality studies are at present (Sept. 1971) being undertaken or are planned throughout the region. The U.S. Geological Survey is conducting circulation and water quality investigations within San Francisco Bay. Much investigative work arising out of, or recommended in, the Bay-Delta Report is being done now. The Contra Costa County Water District and Central Contra Costa Sanitary District are combining in a federally-assisted water reclamation investigation. Together with the several smaller multi-agency studies planned or underway in the nine-county region, the above major studies offer a tremendous input into wastewater planning in the area.

As required by the State Porter-Cologne Act, the Department of Housing and Urban Development and the Environmental Protection Agency, the State Water Resources Control Board and ABAG have established a cooperative program to develop a "Metropolitan Plan" for Waste Water Management by July 1973. This program is being carried out in an effort to provide a unified program which will meet all State and federal requirements and will provide the basis for the allocation of State and federal funds. The planning program will provide a comprehensive approach to wastewater management by considering the total water resources system.

General Philosophy for Study

Within the confines of the scope of the study and taking account of the extensive investigation studies being conducted at present, the following concepts were adopted to define a philosophy within which the study should proceed.

1. Any regional wastewater planning must be aimed towards the return of the entire bay to a state of ecological well-being. To achieve this there must be:
    a. A balance of the total biological life in the bay necessary for a continuing "natural self-purification" of its waters.
    b. A maintenance of bacteriological standards in the bay consistent with unrestricted water-contact recreation and safe human consumption of marine life.
    c. Water quality standards to minimize the acceleration of the eutrophication of the bay system with special emphasis on the south bay and delta areas.
    d. Valid water quality parameters to control the discharge of toxic and cumulatively harmful wastewaters into the bay.
2. Consistent with point 1, the bay does have an assimilative capacity to effect a purification of wastewaters. This capacity is limited and ever-changing, and therefore any use of the bay for final stabilization of wastewaters must be carefully controlled and continually monitored. However, any economically advantageous

use of the bay as a receiving water should not be neglected provided such use is not contrary to the above standards. The discharge of wastewater effluents should conform to the following general principles:

a. The assimilative capacity of the bay waters varies according to location and to any particular period of time. The waters therefore must be "zoned" according to their minimum ability to disperse, dilute, and purify, and individual effluent discharges must be controlled so as to not exceed this capability within each respective outfall zone.

b. Points of discharge must be spread so that the effects of discharge do not overlap and become cumulative. This control must be vested in an effective, regional authority with the power to act as necessary.

c. The quality of effluent, and therefore the degree of treatment to be provided before discharge, is dependent on the location of the outfall point. Periodic reviewing and regrading of discharge zones will be necessary by the authority. Consequential regrading of effluent quality requirements would follow to maintain the waste load in the waters within predetermined standards.

3. Wastewaters are an integral part of the total water resources system of the area, and of the state. In a state with no overabundance of water and in an area from which the naturally occurring supplies are being progressively diverted, wastewater must be considered as one link of a man-made cyclic system, not as the end point of a straightline process.

a. Reuse of wastewaters will reduce the waste loading in the bay as well as decelerate the ever-increasing demand for additional potable water supplies.

b. Although total reclamation may never be feasible, the goal of any water resources system must be the attainment of maximum reuse of wastewaters.

c. Major uses of reclaimed wastewaters in the immediate future will probably be limited to industrial cooling water, agricultural and recreational irrigation, and recharge of aquifers.

d. The ultimate accomplishment of a wastewater reclamation system, that of reuse as domestic water, will necessitate a high standard of treatment and intensive public education. A purposeful effort in these directions must begin now so that this goal can be reached as soon as possible.

4. The ocean outside the limits of the bay also has a capacity for the assimilation and stabilization of wastewater. This capacity is of naturally greater magnitude than that within the bay and would therefore be available to assist in maintaining a balanced ecosystem in the waters of the region. The ocean cannot, however, be considered as an infinite sump in which to "dump and forget." Not enough is known at present about the cumulative effects of continued discharge of massive quantities of partially treated wastewaters into the ocean. By virtue of its complexity and lack of finite bounds, the ocean represents a much more difficult area in which to control and monitor the effects of wastewater discharge than does the bay. Much more investigative study is necessary before the ocean can be considered as the recipient of the region's wastewaters. Unless this is done, future generations may find themselves with the same problems in the ocean as exist in the

bay today. To consider ocean disposal as the ultimate solution is to neglect resource planning concepts that have been developed over the last 30 years and to recreate the old concept of "out of sight, out of mind." This same concept is the cause of the bay's problems today.

In considering any discharge to the ocean, the following factors must also be taken into account:

a. Total transport to the ocean, being by economic necessity a regionwide operation, would tend to inhibit any substantial reuse of wastewater. Once committed to the expense of ocean discharge, the incentive and funding for reclamation could be lost.

b. Increased restrictions and regulations on the discharge of wastewaters to the ocean can be expected in the future as a follow-up to the recent federal limitations on ocean dumping.

5. The alleviation and continued control of wastewater pollution in the waters of the region will necessitate a cooperative effort from all involved parties.

   a. The federal and State agencies in the area now control funding to cover 80 percent of total wastewater treatment costs. This naturally places these agencies in a strong position to dictate the direction in which water pollution control in the area will move. State agencies are obligated to work toward the attainment of the most effective improvements in water quality with the most efficient use of available funds. While there will be few disagreements concerning the water quality goals to be attained, there will undoubtedly be a wide diversity of opinions on how best to accomplish them.

The time is past when local entities can resolutely insist on independent wastewater treatment operations and still rely on governmental funding. The water pollution problem is a regional one and so now is the allocation of financial assistance. The philosophy for the future must be "what is best for the Bay Area that can be accomplished within the means available." This does not imply a policy of "consolidation for consolidation's sake," but it does mean that if consolidation of treatment facilities will provide an improvement in water quality in the receiving waters and is the most economical means to achieve this, then that is the direction in which to proceed. It is the attainment of water quality standards that is the goal, not subregional facilities or removal of wastewater treatment operations from local control.

b. The opinions of the individual sewerage and wastewater treatment agencies in the region must be given due consideration in any water resource management planning. The State has an obligation to listen to such opinions if they represent the feelings of the taxpayer, but it also has an obligation to act to bring clean waters back to the region.

By nature of its organization ABAG may be the logical spokesman for its member organizations in the presentation of differing opinions to any State or federal action or decision on wastewater in the area. It could therefore have an important role to play in water resource management in the region, not in the matter of water quality standards, but as the concerted voice of its members. In line with its role as the HUD areawide planning organization for the Water and Sewer Facilities Grant Program, ABAG must naturally be involved in the wastewater treatment phase in order to provide validity to its sewerage and total water resources planning.

Planning Objectives and Guidelines

The principal objective of any wastewater management study must be the attainment of the highest areawide water quality standards possible. At this point in the Bay Area's history the highest standards possible are fast approaching the ultimate standards.

The short-range objectives are to effect the greatest possible improvement in the water quality in the shortest possible time and to lay the base both for continued upgrading of wastewater effluents and for an effective policy of control and programming in the future.

The long-range planning for this study therefore is centered on the continued improvement in water quality in conjunction with a maximum recycling of wastewater.

In this context, the recommended objectives and guidelines are outlined below:

Objectives

1. Development of a system which produces effluents of the qualities required for maximum beneficial use of the receiving waters.
2. Encouragement of water reclamation and reuse to the maximum extent feasible considering its potential in regional water resources planning. Consideration might be given to providing economic incentives for reclamation projects.
3. Recognition of environmental factors, such as aesthetics, prevention of nuisance, harmony with surroundings, and ecological effects.

Guidelines

1. Recognition of the plan's regional implications in water quality planning and consideration of the following:
    a. Effect on adjoining entities.
    b. Potential for facilities and/or administrative consolidation.

   c. Utilization of existing subregional plans where compatible with long-range plans.
   d. Alternatives available for effluent disposal, both long- and short-range.
   e. Potential for wastewater reclamation.
   f. Interrelationship with other problems, such as storm drainage and solid waste disposal.
2. Recognition of future water quality objectives and consideration of how the facilities might meet these objectives.
3. Consideration of existing federal or State requirements regarding treatment efficiencies and assessment of the capability of facilities to meet these requirements.
4. Identification of environmental factors and determination of how they will be affected by the facilities.
5. Consideration of the adaptation or modification of existing and proposed facilities to provide usable reclaimed water in the future.
6. Comparisons of costs of alternative systems with and without federal and State aid, and consideration of investment in existing facilities.
7. Recognition of unique situations where extensive combined sewers exist.
8. Provision of treatment facilities capable of being used at least 10 years without expansion.
9. Provision for institutional arrangements which will assure proper operation and maintenance of the system.
10. Relation of proposed plans to objectives.

Programs and Plans

In addition to the availability of planning objectives and guidelines, program development requires that consideration be given to the priorities that must be established and the consolidation concepts that must be resolved if a truly regional plan is to be developed. These topics are presented and discussed below.

Priorities

The short-range priorities on which the planning for this study are based are as follows:

1. The removal of all wastewater discharges from those areas of the bay where dispersion, dilution, or natural purification is inadequate. In particular, this applies to the south bay area below Dumbarton Bridge, to the north bay east of Port Chicago, to slow-flushing areas of San Pablo Bay and Suisun Bay, and to shallow areas of the south central bay.

2. The consolidation of outfalls and extension into areas of greater dilution and dispersion. Overall control must be exercised in the location of these outfalls to avoid interaction and cumulative effects between adjacent discharges. In general, outfalls into the deep water channels of the bay will provide the best dispersion. It must be considered, however, that these channels act as flow paths for incoming tidal changes as well as for outflows. Preliminary U.S. Geological Survey studies indicate that fresh water outflow from the delta, flowing near the surface, is replaced coincidentally by a seawater inflow along the deeper levels. Any possibility of a thermal or salinity barrier preventing upward dispersion from a deep outfall must be investigated. Individual testing of outfall locations must be undertaken to ensure the desired result.

3. The general concept of consolidation of treatment facilities to achieve greater efficiency of treatment and operation and for the best use of available money is a valid one. As noted later in the report the economic advantage of consolidating plants of greater than 40 mgd

(million gallons per day) dry weather capacity is minimal and in many cases is offset by sewage transportation costs.

4. Where existing treatment plants are to be phased into subregional facilities the best use of initial funds may indicate a continued use of the existing facilities with transport to, and final treatment at, the subregional plant. The schedule of phase-out for the local plant would depend on its condition and efficiency and on the financial ability to replace its facilities at the consolidated plant. This concept would undoubtedly be the most efficient with regard to initial capital expenditure although in many cases it would mean higher operating costs. It would, however, ensure a more widespread availability of governmental assistance throughout the region and therefore the greatest improvements in regional water quality. The use of funds to pay off existing plants without benefiting from their treatment capabilities would appear to be a waste.

   The procedure recommended generally in this report where consolidation of facilities is suggested would be for the upgrading of treatment capabilities and capacity at a designated subregional plant, the continued use of local facilities until they are paid off or become too inefficient, the transport of the effluent from those local plants to the subregional facility for final treatment, and consolidated discharge to the bay by deep water outfall.

   It is envisioned that the more efficient existing plants will continue in operation for at least 10 to 15 years. Any necessary improvements to these plants would be in proportion to their remaining life.

   Continued use of existing treatment plants has an added advantage from a wastewater reclamation viewpoint. If, as is to be hoped, the next 10 years bring an accelerated effort to achieve maximum wastewater reuse, efficient local plants could form the nucleus for local reclamation projects. Regional reclamation and subsequent transport back to the areas of use seems unfeasible, and it appears at this time that treatment for reuse must be on a local level. This would not negate the subregional final treatment concept as total reuse will probably never be feasible and even majority reuse is undoubtedly a long way off. Wastewater recycling should therefore never create an obsolescence of subregional facilities but could ensure that no increase in capacity is necessary in the future to keep up with increases in population and flow.

Continued use after phase-out of present treatment plants and outfalls for the detention, treatment, and discharge of wet weather peaks is worthy of investigation. The cost of piping to carry peak flows rather than average flows is considerable and may warrant winter operation of existing local plants for this purpose.

5. Until a fully developed bay region wastewater plan is initiated, all interim improvements to present facilities should be viewed in the light of their permanency or possible obsolescence in the immediate future. Where there is a likelihood of consolidation, any upgrading of facilities or extension of treatment must be considered as to its effect on subregional planning in the area. In some cases this may result in "temporary" improvements which, though wasteful of funds at this time, will be the long-range economical answer to water quality control in the region.

6. As previously emphasized, wastewater reclamation and reuse should be strongly encouraged. Until such time, as there exists an extensive market for this water, however, the recycling of wastewater will remain a local operation. In any regional plan where the concept of the "greatest benefit to the greatest area" is to prevail, it would not be reasonable to expect the full quota of governmental finance to be available to local reclamation operations

if that money was needed elsewhere to improve the overall bay water quality.

While this is obviously penalizing those communities with the more advanced thinking it is nevertheless essential that what funds are available be applied where they will do the greatest good for the region. There are financial benefits to a community with a recycling operation in the cutback in imported water demand and in the decrease in wastewater quantity to be disposed. Governmental assistance is still warranted as an incentive and in recognition of the reduction in flow to be treated and of the willingness to act against the pollution problem. The reduction in cost of construction and operation of consolidated facilities should provide a basis for the allocation of funds to reclamation facilities.

Wastewater reclamation during the winter months will not be practiced except for industry or unless storage facilities are utilized. During these months, therefore, all flows would go to the subregional facilities with the local plants available either for detention or for detention and treatment of wet weather peak flows.

Possible uses for reclaimed wastewater are as follows:

a. Short range

    (1) Industrial water--either by internal or by local agency reclamation.

    (2) Local recreational area irrigation--for parks, golf courses, highway planting, etc.

    (3) Agricultural irrigation in local area.

b. Long range

    (1) Recharge of aquifers.

(2) Domestic supply for all uses other than human consumption. This would considerably increase the life of existing water sources and is particularly applicable in new areas.

(3) Export to major agricultural areas, such as the San Joaquin Valley, for supplemental irrigational purposes, possibly in conjunction with storage reservoirs in the hill country between the bay and the valley.

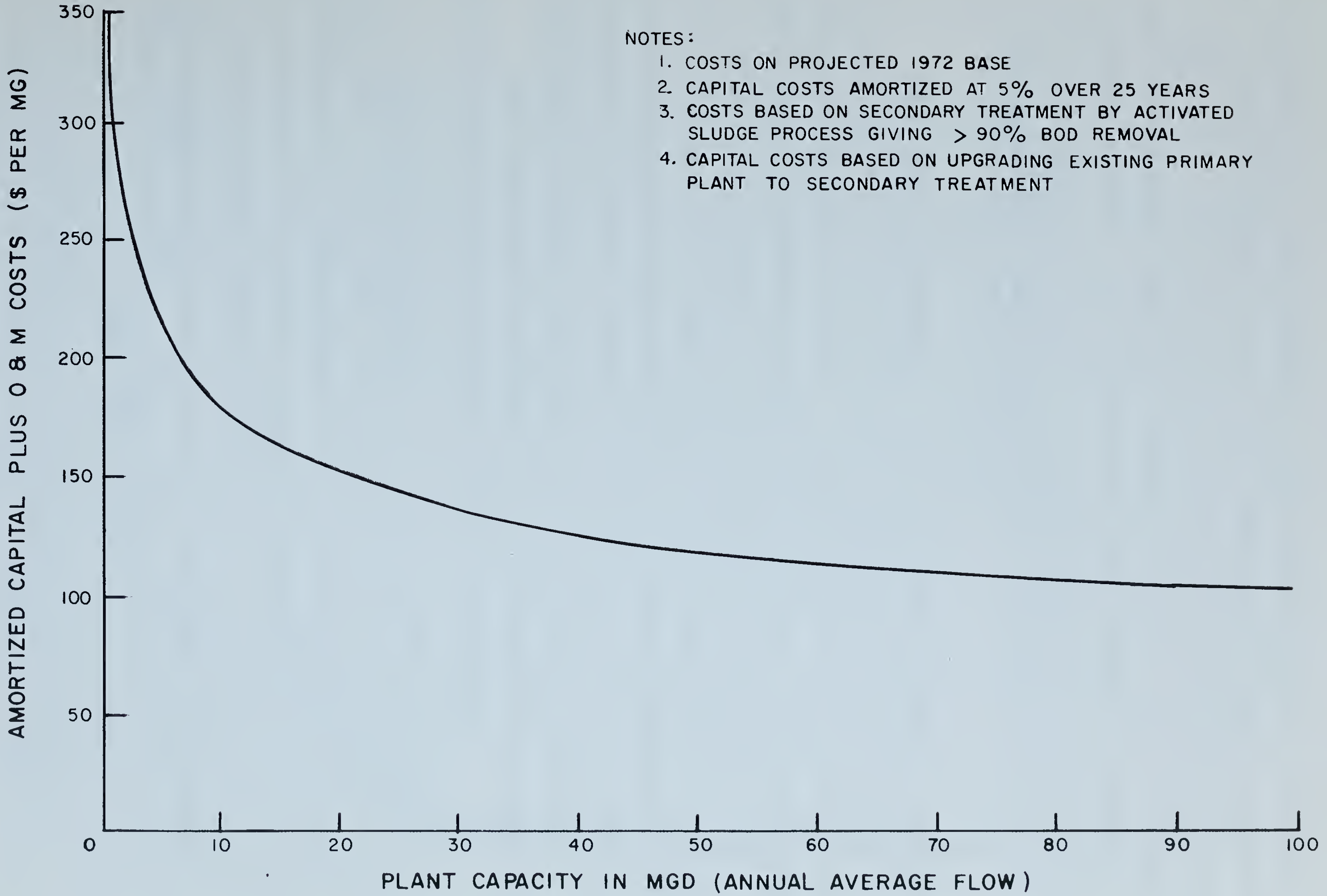
(4) Supplemental discharge into the delta region. The economics of this use is doubtful because of the small percentage of delta flow represented.

(5) Total municipal water supply--the ultimate use necessitating the ultimate treatment.

Concepts for Consolidation of Facilities

Economies of Scale. Economies of scale are usually available in the construction and operation of wastewater treatment plants. As seen from Figure 4, however, these economies are less defined for plant capacities above 40 mgd and almost nonexistent above 100 mgd.

In contrast to these savings is the cost of transporting the sewage to the point of consolidation. This cost varies inversely with the design flow, as shown in Figure 5. Thus, while it will cost around $5 per million gallons per mile to transport a 30-mgd design flow, it will cost around $20 per million gallons per mile to transport a 2-mgd design flow (excluding pumping costs). As a generalization, however, the smaller flows do not have to be transported so far to the adjoining municipality as do the larger flows. The cost of transportation, therefore, does tend toward a constant figure (in dollars per million gallons) when considering facility consolidations between adjacent entities. For an average bayside community it was found that this transportation cost,



NOTES:
1. COSTS ON PROJECTED 1972 BASE
2. CAPITAL COSTS AMORTIZED AT 5% OVER 25 YEARS
3. COSTS BASED ON SECONDARY TREATMENT BY ACTIVATED SLUDGE PROCESS GIVING > 90% BOD REMOVAL
4. CAPITAL COSTS BASED ON UPGRADING EXISTING PRIMARY PLANT TO SECONDARY TREATMENT

FIG. 4 COST OF SECONDARY TREATMENT

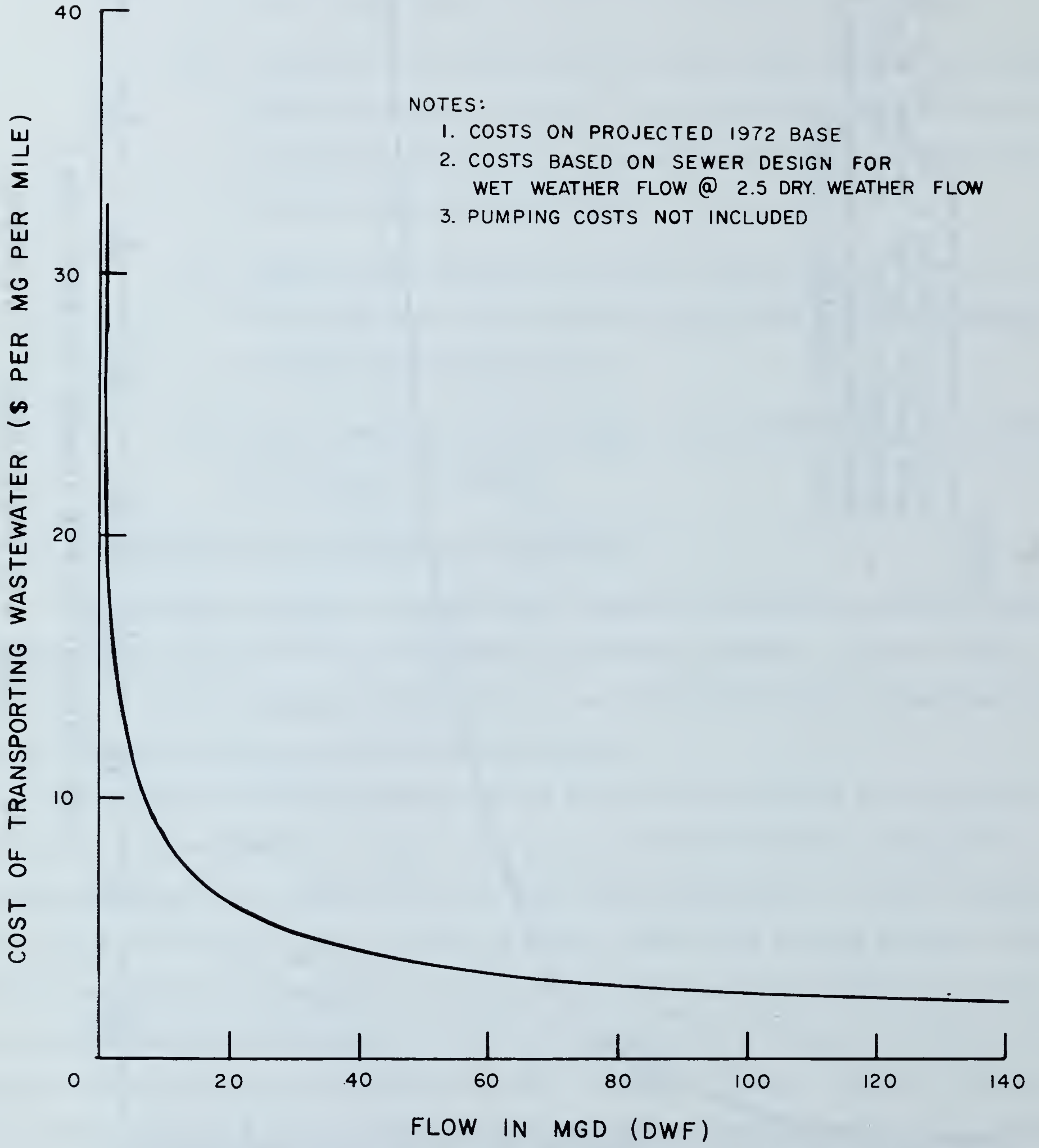


FIG. 5 WASTEWATER TRANSPORT COSTS

when added to the cost of pumping, was in the order of 10 to 15 percent of the total debt repayment and operating costs for a secondary plant treating the same flow. For existing plant capacities above 40 mgd the transportation costs would probably negate any savings in the construction and operation of a consolidated facility. For capacities less than 40 mgd the economies of scale would apparently still be there. The 40-mgd figure is an average one based on accumulated data. Each individual case would require its own cost analysis.

Efficiency of Operation. One of the main advantages to be gained by the consolidation of small plants into a subregional facility would be a general increase in operating efficiency. While there are few reasons why a small plant could not be operated as efficiently as a big one, the fact is that most are not. This lack of efficiency is almost always associated with a marked reluctance of the owner-agency to assign adequate funds to plant operation and maintenance. The observation that this reluctance varies in inverse proportion to the amount of capital investment in a plant is a strong argument for the replacement of small plants by larger, more economical, subregional facilities.

The improvement in effluent quality and control to be gained solely from increased operating efficiency could be substantial.

Consolidation of Outfalls. The cost of outfall construction to deep water zones of high dilution and dispersion will be considerable. There can therefore be substantial savings from the consolidation of outfall lines. However, the economics of this must be considered secondary to the proper location of the discharge point. Extensive investigation must be done both to avoid interaction of adjacent outfalls and to prevent overloading of the biological cleansing capabilities of the receiving waters from too high a waste load at the point of discharge. The best location for the outfalls and the maximum waste loads which can be assimilated by the discharge area must be determined only after all ecological values have been weighed. These factors may well limit the extent of consolidation feasible for outfalls.

Wet Weather Flows. The economy of consolidation of facilities is closely tied to the question of wet weather flows. The sizing of transport facilities, treatment plant, and outfall line must be grossly overdesigned if the problem of infiltration is not overcome. Municipalities throughout the Bay Area are reporting wet weather flow increases varying from 20 percent to more than 1000 percent above the average daily flows. These latter entities, possessing separate sewer systems in name only, must of course bypass their treatment facilities during wet weather and discharge raw sewage into the receiving waters. To prevent this type of pollution these entities must either undertake an extensive program of sewer replacement and repairing or construct facilities to enable treatment for all flows. Several agencies in the region have reported outstanding success in sewer repairs over the last few years, and this is obviously the best answer to the problem. For those older areas where sewer repairs will be a long and costly process the short-range solution at least must be found in the treatment of storm flows or in the detention and later treatment of these peaks. Detention of peak flows in existing local plants phased-out by a subregional consolidation may provide an economical answer for some communities.

Much investigative work in this direction is being done at present by the City of San Francisco which has a legitimate combined sewer system. Primary treatment by sedimentation, air flotation, or fine screening, together with chlorination, may provide sufficient treatment for wet weather peak flows, but each case must be considered separately on predetermined water quality criteria.

The basic fact is, however, that it would be an unacceptable waste of funds to construct facilities to treat and to size interceptor sewers to transport flows which are five to ten times the average daily flow. The problem of infiltration therefore is of the highest priority.

Regional Wastewater Plan, 1970-1990

The foregoing sections of this chapter explain the general philosophy behind the study and the guidelines under which this regional plan was formulated. To reiterate, the guiding concepts were:

1. The greatest overall improvements in water quality in the study area must be achieved within the shortest time.
2. The waters of the bay do have an assimilative capacity to effect a stabilization of wastewater. This capacity is limited and varies with location, and its use must be rigidly controlled and monitored.
3. Wastewater reclamation must be encouraged and expanded not only to reduce the waste load on the receiving waters in the area but also to decelerate the spiralling demand for "new" water.
4. Water quality is the major parameter, not the consolidation of facilities. However, where this latter concept leads to the most efficient improvement in wastewater pollution control, then it should be implemented for the greatest benefit to the region.
5. Regional discharge of partially treated wastewaters to the ocean could in the future create somewhat similar problems in the ocean as exist within the bay today. Such a course would also inhibit the incentive and the capability to recycle and would neglect the available technological ability to treat wastewater to the advanced degree necessary for reuse.

The regional plan falls naturally into two stages: first, that which should be done now to ensure the quickest attainment of present water quality standards; and second, that which sets the course for wastewater management in the future:

1. The short-range program covers that work which should be planned for in the next five years and completed at least by 1980. This program must obviously be flexible enough to allow for revision as necessary to reflect future State, County, and subregional planning. It incorporates alternative programs, within the bounds of the overall planning concept, which can be adopted to account for the more detailed investigations and studies underway now or in the immediate future.

2. No attempt has been made to provide a complete solution to all future wastewater problems in the Bay Area in the long-range plan. The direction in which future planning should proceed is, however, suggested. Future studies may indicate the advisability of changing this direction, and it is intended that all planning be flexible enough to be adaptable without losing its basic concepts. The plan is therefore a guideline plan based on what is considered to be a consensus of the opinions of relevant organizations in the area.

3. The scope of this study did not permit a detailed investigation of industrial waste discharges in the area. Although contact was made with some representative industries the recommendations contained herein are based mainly on trends in industrial wastewater treatment as reported in recent studies. Present countywide or subregional studies are obligated to conduct a detailed investigation of, and to present solutions to, the industrial wastewater problems in their study areas. It was felt that these investigations would provide the valid solution that this problem warrants and that the results of these studies, covering as they do the majority of industries in the region, could be extrapolated throughout the Bay Area.

There are four basic alternatives for the treatment of industrial wastes: (1) by total, individual on-site treatment, (2) by municipal facilities, (3) by subregional industrial plants, or (4) by partial on-site treatment in combination with either of the others. The factors affecting the choice of alternatives are the amount of recycled wastewater that could be used, the quality of the wastewater, seasonal variations in flow, and the degree of treatment and constituent removal necessary before the industrial effluent is acceptable at a municipal plant. There is an urgent need to continue investigation into the effects of prolonged toxic and nutrient discharges and to produce effective parameters for their control.

Industry is an integral part of municipal life and as such warrants encouragement and assistance in solving its wastewater problems. The movement of industries to areas which provide, or assist in providing, adequate treatment facilities can only be counteracted by the same encouragement in the Bay Area whether it be from a local, county, or subregional source.

The following broad guidelines could well provide a basis for future industrial wastewater management planning.

a. Maximum "in-house" reclamation and reuse of industrial wastewaters should be practiced and should be the ultimate goal of all large industrial water users.

b. Construction of subregional industrial wastewater treatment plants to treat wastes unacceptable at the municipal facility.

c. Consolidation of effluent for discharge into acceptable deep water outfall areas or transport to the central bay.

4. No investigation of "random" dischargers was undertaken. This grouping was taken to comprise all organizations or persons other than municipalities or industries discharging wastewaters or waste products into the waters of the region. The main contributors in this category are the federal government, ships, and pleasure craft. Many federal government establishments in the Bay Area lack adequate facilities for waste treatment; there is no question, of course, that these facilities must be upgraded to conform to water quality criteria established for the region and effort to that end is underway. The pollution caused by discharge from shipping in the bay is considerable. Collection and treatment facilities must be provided at piers by port authorities, and a strict control program must be initiated to forbid discharge of inadequately treated waste in any bay waters.

Short-Range Program (5-10 years)

The short-term program recommended herein is intended to provide the most immediate benefits to the waters of the region and to lay the first basic steps in the long-range plan to achieve a continuing improvement in water quality in the region. These are the tasks necessary to improve water quality in the extremities of the bay and in streams and rivers discharging into the bay. The provision of effluent discharges to areas with high assimilative capacities sets the stage for a flexible plan of wastewater treatment improvements. It will allow any particular subregional grouping to decide on its own course of action to meet the requirements of the State Water Quality Control program. Whether this course be continued individual treatment or consolidation of facilities, the short-range program allows flexibility which is not available with the present effluent discharge limitations.

To facilitate implementation of the program it is proposed that the nine-county region be divided into 12 subregions, each composed of agencies sharing similar problems arising mainly from their geographical location. It is envisaged that each subregion would have autonomy over its own wastewater operations subject, of course, to the requirements of regional water quality standards. The subregions are shown in Figure 6 (back pocket).

Requirements

The basic requirements of the short-range program are divided into two tasks, as described in the following discussion.

Task No. 1. This task comprises three parts, as follows:

1. Remove all wastewater discharges from those shallow and slow-flushing areas of the bay which are unable to disperse, dilute, or assimilate the waste loads being presently placed upon them. These wastewaters would be transported to the central bay where there is a much greater natural capacity for self-purification.
2. Transport "difficult" wastes to the high dilution areas of the central bay. These are wastes which require specialized, expensive treatment but which in dilute form would have little toxic or cumulatively harmful effect on the receiving water. Ultimate treatment of all such wastes or alternative means of disposal is, however, considered necessary.
3. Construct consolidated outfalls to those areas of the bay where dispersion is greatest and where the maximum dilutional capacity and assimilative capability of the bay can be utilized.

It is obvious that these first priorities are, at best, only interim, emergency measures rather than solutions since it should never be entertained that the central bay has an infinite capacity for waste treatment. They are only the first and most urgent steps towards achieving a return to clean water in the region. They must be closely followed by a continued improvement in the degree of pre-discharge treatment.

Task No. 2. This task comprises three parts, as follows:

1. Upgrade all treatment facilities to a standard compatible with the assimilative capacity of the effluent discharge point.
2. Prevent raw sewage discharge at all times, whether it results from wet weather overflows or from random discharges.
3. Quantify the maximum level of discharge for wastewaters containing toxic materials or nutrients, and establish parameters for the control of these effluents.

There are at present many treatment plants in the area which are not providing a sufficient standard of treatment to meet existing State water quality requirements. It is to be hoped, and it is anticipated in this report, that all of these plants will be upgraded to meet the State requirements before the proposed effluent interceptors are constructed. It is not intended, therefore, that this type of plant will be discussed in this report. In some parts of the region, such as in San Mateo County, there is a continuing program of multi-municipality consolidations. In other parts of the region, notably in Contra Costa County, there remain numerous small communities, each treating its own wastewaters. In most cases the cost of such independence is high and the degree of treatment provided is low. Until the results of the present Contra Costa study are known, no firm recommendations on wastewater treatment will be made in this report. It does appear, however, that the cost of providing a sufficiently high degree of wastewater treatment will bring about many consolidations of treatment facilities in this county. For those areas not tributary to the bay and hence not served by the proposed effluent interceptors, the short-range program consists of upgrading treatment as required to meet water quality standards. In many cases the cost of achieving these standards by individual action is high and consolidation of facilities is suggested for economy as well as efficiency.

The deletion of all wet weather overflows of raw sewage into the waters of the bay is, in general, a problem of overcoming infiltration of stormwater into the existing sewer line. As such, the problem falls into the category of sewer improvements and is discussed more fully in the sewer section of this report. Although the problem of raw sewage discharge from random dischargers, such as shipping and some federal government installations, is beyond the scope of this report, it is nevertheless of high priority and warrants immediate action.

The problem of toxic and nutrient discharge into the waters of the region is one which must be overcome in the immediate future. Until the results of certain studies in this area are known and standards can be set for these wastewaters, however, it is not possible to set guidelines for control except to note the seriousness of the problem.

Existing sewerage facilities by county are listed in Tables 13 through 21 (pages 119 through 136), and all of the short-range plans reported by the agencies are tabulated in Table 22 (page 137).

Implementation

Implementation of Task No. 1 is delineated, by subregion, in the following discussion.

South Bay Subregion (Menlo Park, Palo Alto, Mountain View, Los Altos, Sunnyvale, San Jose, Milpitas, Union Sanitary District, Valley Community Service District, Livermore). These communities and districts form a logical subregion since they share a common effluent discharge problem. Most of them discharge at present into the very shallow, slow (and often reverse) flushing area of the bay below the Dumbarton Bridge. Menlo Park has its outfall into a slough just north of the bridge, but geographically and politically would appear to be best considered in the same grouping as its northern Santa Clara County neighbors, especially since it is at present a participant in the South Bay study. The Livermore Valley communities discharge effluent into Alameda Creek, as does the northern plant of the Union Sanitary District (Alvarado), and they are also participating in the South Bay study.

During the dry months of the year it has been determined that there are times when there is actually no outflow from the area of the bay south of the Dumbarton Bridge. Even at the best times the dilutional effect of this area of the bay on the wastewater load being discharged into it is small. There are many times during the year when the available oxygen in the waters is depleted well below the minimum amount considered necessary to support a diversity of marine life. The rapid growth in the area will make it increasingly difficult to attain a degree of wastewater treatment which would prevent a continuation of the oxygen depletion in these limited receiving waters. The solution, therefore, would be to consolidate all wastewater effluents from this area of the bay and to transport them to areas where the receiving waters have sufficient assimilative capacity to withstand the demand for oxygen without detrimental effect.

It is possible that this could be accomplished for the immediate future by a consolidated discharge just north of the Dumbarton Bridge. A more lasting solution, especially in light of the enormous growth potential of this subregion, would be to carry the discharge point up into the central bay area with an outfall line into the deep water channel either at the San Mateo Bridge or preferably up to a point opposite Oakland Airport. These lines could run up the east side of the bay since it is considered that this route would be easier and less disruptive to existing land uses although a west side route would entail a shorter outfall.

The best route for this interceptor will, of course, require detailed study. Economic analyses would also be required to determine whether the northern Santa Clara communities and Menlo Park would connect to an east-side interceptor by way of a bay crossing or around the south end of the bay. The Livermore Valley communities would presumably connect by following the general line of Alameda Creek down to the bayshore.

East Bay Subregion (Hayward, Oro Loma-Castro Valley, San Leandro, East Bay Municipal Utility District). The southern three entities of this subregion all have outfall problems in that they discharge at present into sloughs or into shallow areas of the bay. Trouble has been experienced in meeting State water quality requirements because of outfall location in conjunction with the degree of treatment provided. The immediate task for these three communities would therefore be to provide a deep water outfall. A consolidated outfall into the deeper waters of the bay would probably be most economical, with a location opposite San Leandro preferable. The present East Bay study will provide the detailed investigations necessary to determine the most suitable location weighing the economics involved and the bay's assimilative capacity. Other possibilities would be to connect into the recommended South Bay interceptor for discharge off Oakland Airport or to connect northwards into the East Bay Municipal Utility District interceptor and outfall. The South Bay line, however, will be serving some 2 million people by 1990, and it may prove unwise to add the waste load from another 0.5 million people to the same discharge area. If the existing south-to-north interceptor and outfall in the East Bay Municipal Utility District area have capacity to accept the three southern entities, then connection to this may provide the best answer. If, however, a new interceptor is required, then the cost of constructing it through the heavily built-up areas would seemingly preclude this alternative.

Special District No. 1 of the East Bay Municipal Utility District is apparently one of the few areas in the bay region without the need of a major redirection of its wastewater disposal system. The District has a well-located, deep water outfall into a high-dispersion and fast-flushing part of the bay with adequate capacity for the future. With the proposed addition of chemical treatment facilities in 1972 the District should be in a position to meet future water quality requirements for the next 30 years. Like most well-established areas in the region, the District does have an excessive wet weather flow problem which will necessitate an extensive sewer sealing program or facilities to handle these high flows.

There is, therefore, no apparent need for any short-range remedial measures to be undertaken by the East Bay Municipal Utility District within the scope of this study, other than those which the District is now planning.

Contra Costa County Subregion (Total county with the exception of the former Stege Sanitary District, now annexed to East Bay Municipal Utility District). All existing wastewater outfalls in this area except that of the City of Richmond either discharge directly into, or ultimately flow into, the slow-flowing, low-flushing areas of Suisun and San Pablo bays. With the extensive industrial development along the shoreline and the major residential areas of the central valley and western county, an excessive waste load is being placed on these waters at present. As with the south bay, it is doubtful if advanced waste treatment could ever be enough to maintain an ecological balance in these waters, and an interceptor for all wastewater effluents from Antioch westwards with discharge into the central bay at Richmond is recommended.

There is considerable recycling of wastewater being practiced at present by industries in the area and much more is being planned. This of course must be encouraged but there will, at least in the foreseeable future, always be a need for collection and transport of effluents to better disposal areas. To bring an immediate improvement to the waters bordering Contra Costa County, a cross-county interceptor is considered the best solution. Construction of the line is considered one of the top priorities in the bay region. Sizing of the line will depend on the amount of recycling envisaged but it should be adequate to accept all wastewater effluents from the area.

The eastern communities of Oakley, Brentwood, and Byron could also join the interceptor but should first consider disposal by land irrigation as being probably the less expensive as well as the most beneficial.

Bayside San Mateo County Subregion (except Menlo Park). Wastewater treatment in this subregion is generally of a high standard although there is a need for better outfall locations in some areas. Pending the results of present studies it is suggested that the solution to the subregion's discharge problems, at least in the short range, may be found with three deep water effluent outfalls. They would be the recently completed line serving Belmont-San Carlos and Redwood City, the San Mateo outfall to serve the Estero Municipal Improvement District also, and a new line off San Francisco Airport for all areas between Burlingame and South San Francisco. Interceptors connecting communities to the outfall must, of course, be constructed. The areas from Brisbane north would apparently be best suited to treatment at San Francisco's South-East plant.

City and County of San Francisco Subregion. San Francisco's three existing outfalls appear sufficiently well-located to negate any priority change in the short-range program although extensions into deeper waters will be necessary. The City, of course, has the problem of a combined sewer system with a treatment system unable to withstand the consequent wet weather flows. Economics studies have indicated the magnitude of cost of separation of these flows, and the City has now made the decision that the only feasible action is to treat all flows and to make no attempt at separation.

San Francisco, however, is in a position to solve its own problem and therefore logically falls into a subregion by itself. The City has an existing program for the next four years calling for an expenditure of some $35 million for expansions to dry weather flow treatment facilities, including specific constituent removal and outfall extensions. Additional as-yet-unplanned improvements could easily double that expenditure in the time span of the short-range program as water quality requirements become more rigid. In addition, the City must find the best way to deal with storm flows and to overcome the present discharge of untreated sewage into the bay during these times. Whether this be by immediate treatment, by withholding storage and subsequent normal treatment at low flows, or by discontinuing discharge to the bay and rerouting to an ocean outfall will not be predictable until comprehensive studies are completed.

South Marin County Subregion (Sausalito-Marin City, Mill Valley, Richardson Bay, County Sanitary District No. 5). There is an urgent need for the effluent discharges from the Mill Valley and Richardson Bay facilities to be removed from the confines of Richardson Bay. The discharge points for District No. 5 and Sausalito-Marin City are at the entrance to the bay and as such may overcome their discharge problems by individual outfall improvements. However, the economical answer for this subregion could be for all effluent discharges, rather than just those from Mill Valley and Richardson Bay, to be consolidated into a common interceptor discharging into the ocean by way of Tennessee Valley. Present studies will indicate the best and most economical solution for the subregion as a whole. Whatever the final decision proves to be, it is recommended that the short-range program for this subregion consist of improvements to existing discharges by provision of greater dilution and dispersion than that now being provided for the individual outfalls.

North Marin-South Sonoma County Subregion (County Sanitary District No. 1, San Rafael Sanitation District, Las Gallinas Valley Sanitation District, County Sanitary District No. 6, Petaluma and Sonoma Valley County Sanitation District). It is recommended that a short-range program for these communities be developed to intercept all effluent discharges to San Pablo Bay and to transport them to the deeper waters of the central bay. It is suggested that a single interceptor with discharge at the San Rafael-Richmond Bridge may prove more economical for the subregion as a whole, but if present studies indicate the feasibility of a second outfall at Point San Pedro, then this is a viable alternative.

This effluent interception would enable bypassing San Pablo Bay completely as a receiver of wastewater effluent and would enable removal of all existing discharges to the Petaluma River and Sonoma Creek. The benefit to these low-dilution receiving waters would be immediate and extensive and would provide the basis for continued, coordinated wastewater planning in the area.

Napa County-South Solano County Subregion (Napa Sanitation District, American Canyon County Water District, Vallejo and Benicia). It is recommended that the short-range program for the southern portion of Napa County consist of the removal of all wastewater effluent discharges from the Napa River. It is therefore proposed that an effluent interceptor be constructed from the Napa Sanitation District southward to collect all effluent in the southern part of the county and then to join an interceptor collecting effluent in the southwest part of Solano County. It is recommended that this line then join the cross-county Contra Costa interceptor at the Carquinez Bridge for discharge into the central bay below Richmond. In a similar manner the effluent from the City of Benicia's treatment plant would join the Contra Costa interceptor at the Benicia-Martinez Bridge.

The extension of the Napa Valley interceptor northward will depend upon the results of individual studies in the area. It is recommended, however, that the cities of Yountville, St. Helena, and Calistoga investigate first the possibilities for wastewater reclamation and reuse before joining an extended valley interceptor. There appears to be considerable demand for this type of water both for irrigation and for frost protection.

Solano County (except Vallejo and Benicia). Pending the results of future studies, it is considered that the Solano County communities will find the answer to their short-range effluent disposal programs in irrigation and land disposal rather than in transport to areas providing greater assimilative capacity than is available at the existing discharge points. With the abundance of open land available around these communities, it is hoped that their wastewater effluent can be put to beneficial use by discharge to the land. In some areas there is a high solids and nutrient content in the wastewaters. This must be overcome for effective irrigational use and therefore forms part of the short-range program for the area.

Implementation of the recommended program would enable present discharges to streams and sloughs to be discontinued, and would appear more economical than upgrading treatment to the required standards for discharge.

Coastal Subregion (those areas of San Mateo, Marin, and Sonoma counties with effluent discharges directly to the ocean). The coastal communities of San Mateo County fall naturally into three groups, and it is recommended that the answer to their wastewater control problems be found within those groupings. All three groups are at present conducting studies to find the best solution to these problems. The North San Mateo County Sanitation District is investigating the feasibility of reclamation and reuse of a large part of its wastewater. The District also has plans for an ocean outfall extension and an expansion of its existing treatment plant within the next five years. It is therefore considered that the District has a suitable short-range program of its own which can form an acceptable part of a regional plan.

The City of Pacifica has plans for a consolidation of its existing two treatment plants with secondary treatment and a deep ocean outfall by 1980. These plans constitute a viable short-range program for the city to be incorporated into a regional plan.

The third group comprises Half Moon Bay, the Granada Sanitary District, and the Montara Sanitary District. A consolidation of these three districts would appear to be the logical path to solve wastewater problems in this area. Upgrading of treatment facilities and a consolidated ocean outfall would enable the area to meet the State water quality requirements, and it is considered that this would best be accomplished by a joint operation by the three entities. However, any recommended solution to this area's problems should await the results of the study presently being done. Also, the demand for reuse as well as outfall location must be considered in the location of any consolidated facilities.

The coastside communities of Marin and Sonoma counties are small and isolated and no short-term programs or recommendations for these communities are being proposed in this study. However, if the growth rate in the next few years is such as to necessitate expansion of treatment or extension of outfalls, then these will constitute part of the short-range program. This may occur in the Stinson Beach-Bolinas area or the Tomales area but is unlikely elsewhere.

Sonoma County Subregion (except for southern portion which is tributary to San Pablo Bay). To continue to meet State water quality requirements, these communities have little option other than to provide the necessary standards of treatment. Although the possibility of an ocean discharge from the Santa Rosa area is being considered the practicability of this has yet to be demonstrated. Any such project therefore will be far in the future. To achieve the treatment necessary in the foreseeable future it is recommended that the possible economies and increases in efficiency from consolidated facilities be investigated. Joint facilities for Santa Rosa and Sebastopol and for Cotati and Rohnert Park are an initial step, but it is suggested that a combined facility for the complete south end of the plain would offer the most effective means to achieve the anticipated effluent standards of the future. Consolidated facilities for the central plains and Green Valley areas would also appear to be warranted, but the timing of these will depend on rate of growth.

Provision of a consolidated facility for the south plain area in the short-range program will enable this area to provide environmental safeguards more efficiently in the future. Because of size and distances, consolidation of facilities in the northern section of the county is not considered feasible and individual treatment will continue.

South Santa Clara County Subregion (portion of county tributary to Monterey Bay). The timing of the subregionalization recommended in the long-range plan for this area will depend on the rate of population growth. It is essential, however, that sufficient coordinated planning be undertaken within the time frame of this short-range program to ensure an orderly and controlled development of wastewater management in the subregion. Before the predicted development in the area progresses too far there should be a complete and comprehensive wastewater plan. It is suggested that the basis for this plan be a total subregionalizing of treatment facilities comprising a north-to-south interceptor, sized for the whole subregion, transporting all sewage to a single treatment plant. The location for this plant would appear most suited to the Gilroy facility. This is the only plant in the subregion at present (serving Morgan Hill also) and, with its location at the lower end of the valley, it appears to be the most logical site for the subregional facility.

Immediate short-range plans for the region will center around improvements and extensions to the Gilroy treatment plant. The City's present plans to upgrade the primary ponds, and then to construct a new secondary treatment facility, are well suited to the ultimate subregionalization recommended. The timing of these new facilities, as well as the recommended interceptor, will depend on growth rates and financing. These plans, however, conform well to the envisioned short-range and long-range wastewater planning requirements for the area.

Summary of Task No. 1. The priority items of Task No. 1 of the short-term programs are as follows:

1. The Contra Costa County interceptor with discharge into deep water below the city of Richmond.
2. The south bay subregional interceptor with discharge into the deep waters of the central bay.
3. Consolidated deep water outfall for Hayward, Oro Loma, and San Leandro.
4. Prevention of raw sewage discharge from the city of San Francisco during wet weather flows.
5. The consolidated outfall for south Marin County, the Petaluma-to-San Rafael interceptor, and the Napa Valley-Vallejo interceptor, all share a similar priority, together with the improvements necessary in coastal San Mateo County and in the communities of Solano and Sonoma counties.
6. The consolidation of the outfalls into deep water for the bayside San Mateo County districts and the improvement of treatment at the East Bay Municipal Utility District's plant.

The transport of effluent to areas of the bay which will provide greater dispersion and dilution should not be considered an excuse for a regression in the amount of treatment provided for the wastewater in the region. The danger of such a program is that it could lead to a false sense of accomplishment. While it is considered that this recommended program will provide the most immediate benefits to the bay and will always be available as a backup in the future, it should be considered only as the first step toward permanent water quality improvements for the region. It must be followed by a continued improvement in the degree of treatment provided by every community in the study area.

It would therefore seem appropriate that costs for the recommended interceptors be apportioned in accordance with the waste load as well as the flow from each participating community. Cost apportionment must be such that it is economically advantageous to give wastewaters a high degree of treatment before discharge into the effluent interceptor. If the charge to each contributor is set in excess of the amount of debt repayment and maintenance necessary, the excess could be set aside for any future subregional plants that will be necessary to provide a final degree of treatment. In this way those plants providing the lowest degree of treatment would be contributing more toward the time when their effluent will result in final treatment being necessary. Conversely, those contributors with a higher degree of treatment and those who were reclaiming and reusing their wastewater would be rewarded by a lesser charge. Unless costs are apportioned along these or similar lines, there will be no incentive to a community to provide any higher degree of treatment than that provided by the community with the worst effluent. If such a situation were allowed to develop, there would be a general regression in the water quality in the area. It is recommended that each subregion have control over the operation of, and the debt repayment for, its own interceptor. In this way each area can decide how best to achieve the end result of meeting State water quality standards and how best to apportion the cost of achieving this goal.

Long-Range Plans

With the implementation of the recommended short-range program, the region would be in a position to adopt a flexible course along one of a number of alternative routes. The consolidation of effluents, with discharge to receiving waters having high assimilative capacities, would allow those areas with present discharge problems to maintain a flexibility of action in attaining water quality requirements. Each subregional group can then decide how best to reach the necessary standards of treatment subject, of course, to overall regional planning. Whether this be by consolidation of treatment facilities or by final subregional treatment is a decision to be reached within the group.

Such subregionalization of wastewater treatment not only should lead to an easier regional control of discharges, but also should enable a more positive enforcement of treatment standards by the subregions themselves. With the apportionment of costs within any group scaled to provide economic incentives for diminished waste loads and wastewater flows, an increase in the degree of treatment and a continued effort toward recycling must result.

Maximum wastewater reclamation and reuse must continue to be the ultimate objective of the long-range plan. As emphasized previously in this report, the region should be looking to wastewater as an alternative source of water supply for the future. Although possible uses represent only a small percentage of total wastewater flows at present, they form a significant step towards the double benefit of decreased waste discharges and decreased water demand. Wastewater recycling by industry and use for recreational and agricultural irrigation is a course which can be implemented and encouraged now. Other uses will undoubtedly follow with technological advancement and increased public acceptance. If wastewater recycling were to increase at the same rate as the demand for water, the benefits both economically and environmentally are obvious.

Wastewater recycling will remain essentially a local operation for the foreseeable future. Present indications tend toward individual reclamation and reuse by industry with a possible extension to local industrial waste treatment plants. Irrigational use will probably be confined to parks, golf courses, and agriculture in the local area. Aquifer recharge may entail a subregional operation, but until such time as extensive use is made of this resource, the obvious, and in most instances the most economic, location for reclamation is at the local treatment plant. The cost of re-transport must, of course, be balanced against the cost of advanced treatment facilities, and for some smaller plants, the cost of reclamation may be too high. However, until such time as wastewater recycling finds extensive use for such projects as for an irrigational supply to large areas such as the San Joaquin Valley, for a duplicate domestic irrigation supply, for extensive groundwater recharge, or for the ultimate of total domestic use, it is anticipated that reclamation facilities will be mainly at the local level.

This concept, of course, fits easily into a long-range plan built on the foundation of the recommended short-range program. With the flexibility provided by the availability of a deep water bay outfall, local entities can construct reclamation facilities for that portion of their total flow for which there is a demand. Acceptable treatment standards for the remaining discharge, or for the total flow during low recycled demand, can always be maintained. A community may even end up with an advanced treatment plant sized to local demand with the remainder of its flow being treated at a multi-municipal or subregional plant. The backup safeguard against fluctuating recycled demand is provided by the deep water outfall.

The long-range plan proposed for the region is not a detailed recommendation on what each community should do. It can only be a general view of how each suggested subregion in the area can proceed in order to meet water quality standards designed to protect the ecology and environmental resources of the region.

South Bay Subregion

The degree of treatment which will be provided by the existing plants in this subregion when all immediate construction is complete should enable present water quality requirements for a central bay discharge to be met. However, the predicted high growth rate in the area will necessitate substantial expansion of treatment facilities and upgrading of effluent standards to meet future waste loads. In general, existing treatment facilities are of a capacity where economies of consolidation are not so evident although there are several possibilities which are worthy of investigation.

1. If the best route for the recommended interceptor serving the north Santa Clara County communities and Menlo Park proves to be a bay crossing at the Dumbarton Bridge, then a consolidation of treatment facilities at a subregional plant near the bridge may prove economical to these communities. Extension of these facilities to include the city of Sunnyvale may also be worthwhile. With the cost of sewage transport being assigned to the recommended interceptor, there should prove to be a savings in treatment costs for these communities at a consolidated facility. The predicted growth rate in these communities is sufficiently small that the cost of individual treatment would remain significantly more than the cost of consolidated treatment.

2. A consolidation of Milpitas and the Irvington plant of the Union Sanitary District together or with San Jose may offer financial benefit. Growth in the Milpitas area is limited and, while that in the Irvington area will be substantial, neither plant will operate at what is considered an optimum economic capacity.

   Growth in the Union Sanitary District will be rapid and although the two northern plants of the District are small at present it is doubtful if there would be any benefit in the future consolidation of these facilities.

3. Consolidation of the existing treatment facilities in the Livermore, Amador, and San Ramon valleys into one plant would appear to have economic benefits since all areas have a common outflow. There will remain a market for reclaimed wastewater for irrigation purposes if the decreasing demand from agriculture due to urbanization is replaced by provision for irrigational use at the domestic and recreational level. However, an economical answer to the problem of high dissolved solids in the wastewater is urgently needed and stands high on the priority list of wastewater research planning for this area. Future use of the recommended branch interceptor from these communities as a backup line for nonreclaimable wastewaters will provide the safeguard to what hopefully will be an extensive recycling operation. Whether this operation would be most economical on a local level with a consolidated plant for the "excess" or on a total consolidated basis must be determined from future studies.

   Apart from the possibilities for extensive reuse discussed in the Livermore area, the most likely demand for reclaimed wastewater in the subregion is from municipal and recreational irrigation in all communities and from groundwater recharge principally in the Santa Clara Valley and in the Niles aquifer in the Union Sanitary District. The increased water supply to the San Jose area from the South Bay Aqueduct may, however, negate much of the demand for aquifer recharge by reclaimed water.

Advances in technology and a subsequent decrease in the cost of reclaiming wastewater may, in the future, reverse the economics of importing water to the area and may create a renewed demand to make use of the treated wastewater source.

East Bay Subregion

With the planned upgrading of treatment, the adequate existing outfall to deep water, and the relatively stable population, it is considered that the East Bay Municipal Utility District will, by 1975, have facilities sufficient to meet water quality requirements to the year 2000. Although a wastewater reclamation and reuse study is presently underway, it is anticipated that the only significant demand for recycled water in the area will be from industry. Whether this would be accomplished by industries themselves or by the District is unknown at this time. Either way, the possibilities for wastewater reuse represent an important facet of the long-range wastewater planning for the District.

With the provision of an effluent interceptor and a deep water outfall in the short-range program, the three southern communities of this subregion would be in a completely flexible position with regard to treatment facilities. The Oro Loma Sanitary District (including Castro Valley) is now completing secondary treatment facilities, and similar extensions are planned for San Leandro in 1972 and for Hayward around 1975. If the best outfall location for the proposed effluent interceptor proved to be opposite San Leandro, there would appear to be cost savings to be gained from a consolidation of facilities since the means of sewage transport would already be provided. A decision on this would, of course, be made as a result of studies by the communities concerned as would the question of whether such a consolidation would be of total treatment or of only secondary treatment.

There is a good potential market for reclaimed wastewater for irrigation purposes in the area, particularly in San Leandro. There are also significant possibilities for reuse by the industries in the area. Here again, the way is open for implementation of any one of a number of possible solutions. It would appear that reclamation would prove most economical when carried out at the local level. Unrecycled wastewater could then be treated at either the local or subregional level with an assured discharge to deep water.

Contra Costa County Subregion

Although construction of the proposed cross-county effluent interceptor would provide an immediate and revitalizing benefit to the existing receiving waters of the subregion, the area contains the most potentially hazardous wastewaters in the whole region. While a start has at last been made in the past few years on improving wastewater treatment, much remains to be done for many years to come.

The subregion has two major problems. First is the tremendous industrial wastewater load, and second is the large number of small, independent municipal plants providing uneconomical and usually inefficient treatment.

The first problem can be met by a combination of individual treatment with maximum recycling at the larger industrial plants and a series of subregional industrial waste plants providing treatment for the smaller industries before discharge to municipal wastewater facilities. The present countywide study and others to follow will provide the necessary detailed solutions, but subregional planning must account for the vital need for increased treatment for industrial wastes in the area and for the incentive toward maximum reuse of wastewaters and minimum demand for "new" water. A balance must be found between recognition of the importance of industry and the importance of environmental protection. Prevention of pollution is a regional concern and as such must be faced by the areas concerned and not merely left to the polluters alone. The long-range plan for the area must, therefore, be actively to encourage recycling of industrial wastewaters and to ensure that the unreclaimed remainder is treated to a standard compatible with a balanced ecology in the receiving waters. If it proves more feasible to achieve this at subregional industrial facilities, then this must be included in any long-range planning.

The second problem in the area, that of the numerous uneconomical plants, could best be overcome by consolidation of facilities. That this has not yet been accomplished, in spite of several study recommendations, can only be explained by a steadfast independence, to the detriment of both environment and economics. Any long-range planning should therefore include consolidation of treatment facilities. Apart from reuse by industry, which in all probability will be an operation performed by the industries themselves, the only extensive demand for reclaimed wastewater appears to be from the central valley and the eastern agricultural areas. It would seem logical, therefore, for the long-range planning to provide for the construction of subregional municipal treatment facilities both at a Central Valley location and prior to the discharge point at Richmond. The short-range program provision of the cross-county interceptor would be the means of transport to these subregional plants.

The Central Valley plant, presumably at the Central Contra Costa County Sanitary District facility may ultimately treat only that part of the flow which can be reutilized in that area. However, treatment of the total flow and redischarge of the unusable portion to the cross-county line carrying raw sewage would apply the same hydraulic load to the Richmond plant without the waste product load that would occur if no treatment were done in the central valley. It is not considered that this situation would be uneconomical since it leaves the central area with the flexibility to encourage reuse. The deep water discharge at the central bay again offers the backup to any such fluctuation in flow at the final treatment plant.

The problem of infiltration and high wet weather flows in many of the communities in this area may warrant invesigation of the feasibility of maintaining some of the existing plants for retention purposes during these times. In those areas where the infiltration is worst it may be of benefit to withhold storm flows in the phased-out plants until such time as the subregional facility can effectively treat all wastewaters. The feasibility of such a system to overcome the problem of sizing facilities to accept flows of ten times dry weather flows would naturally require close study.

Bayside San Mateo County Subregion

As previously stated, the treatment of wastewater in this subregion is of a consistently high standard and as such may not warrant any further consolidations than are already underway or planned. However, the construction of the recommended effluent interceptors would make the economics of joint facilities an attractive proposition. Such facilities would be located immediately prior to the outfall discharges preferably as an extension to existing plants where such expansion is practical.

There is a significant demand for recreational irrigation in the area, and this is expected to increase steadily with the continued development of the bayshore areas. Reuse for domestic irrigation in these new developments can also be expected since they are adjacent to treatment facilities. Advanced treatment at a local level to meet this irrigational demand, with subregional facilities for the excess wastewater, may prove to be the long-range solution for the area.

City and County of San Francisco Subregion

Long-range planning for San Francisco will doubtless follow as an extension of its short-range goals. Continuation of the City's efforts to overcome wet weather flow problems will be the focal point in the future. Advancement in the degree of treatment, the provision of deep water outfall areas, and expansion of present levels of reclamation will enable the City to find its own solution to immediate environmental problems. Although no prediction can be made at this time on the long-range planning details, the City is obviously aware of the enormity of the problem facing it and is prepared to take whatever steps are necessary to meet water quality requirements. A $35 million program is predicted in the next four years for dry weather treatment expansions, specific constituent removal, and outfall relocation. However, it is estimated that some $200 million will be required to control pollution from the City's combined sewer system. Although the detailed master plan is still being worked on, it is likely that future wet weather flow planning will be concerned with providing sufficient treatment for these flows to prohibit pollution and with retention facilities for withholding storm flows until adequate treatment can be provided. It is estimated that half of the work will be completed by 1981 with the remainder completed by 1988.

South Marin County Subregion

As a continuation of the immediate benefits to the inner bay waters of a consolidated deep water effluent outfall, it would seem logical that the first step in a long-range plan for the area would be a consolidation of treatment facilities. With a predicted doubling of the present population in 20 years the economics of a continuing expansion of individual plants would be doubtful.

There is apparently little potential in the area for wastewater reuse so that localized treatment offers few advantages. Depending on the final decision on the provision of deep water outfalls, a subregional plant, as an expansion of an existing plant or as a new facility prior to discharge, may form the basis of long-range planning in this area.

North Marin-South Sonoma County Subregion

With all wastewater discharges removed from San Pablo Bay and the waterways in south Sonoma County by the construction of the recommended interceptor and outfall to deep water in the central bay, the long-range plan for this subregion would center around improvement in treatment and wastewater recycling. As with most of the other proposed subregions this area can follow a policy which the communities find most acceptable and economical in achieving the necessary control over their wastewater problems.

There will be a steady and significant demand for reuse of wastewater in the future, mainly for recreational and agricultural irrigation, particularly in the Las Gallinas Valley and in Sonoma County. Since most of this demand will be localized it will doubtless be the individual community which will provide the necessary advanced treatment. It would appear most advantageous for the excess wastewater to be treated on a subregional basis. The predicted population in the future would not appear to warrant more than one such plant being used. A decision on subregionalization, however, must result from a comprehensive study. If one plant is found to be the best answer its location would be most logical near the point of discharge. The degree of treatment to be provided will, of course, be decided by the loading on the central bay waters adjacent to the discharge point in the central bay area.

Napa-South Solano County Subregion

Long-range planning for this subregion will be concerned with extensions in total treatment to meet water quality standards and with maximization of wastewater reclamation and reuse.

The extent of the former will be dependent on the assimilative capacity of the central bay to effect final treatment on effluent discharges. With the recommendation that the area's effluent interceptor join the Contra Costa interceptor for transport to the central bay a high hydraulic and waste load will occur at the discharge area. Whether this will entail more than secondary treatment in the future is, of course, pure conjecture at this point. It is highly possible, however, that a subregional plant at Vallejo will be necessary to reduce the waste load being received by the Contra Costa interceptor. This would appear a more economical answer than continued local treatment of total flows.

There are, however, extensive possibilities for irrigational reuse in the area, particularly in the Napa Valley portion. Reclaiming of wastewater for this purpose would be economical only on a local treatment level and would indicate a continued operation of local plants. Such facilities would, of course, be of a capacity corresponding only to the amount of reclaimed wastewater required in the area. The remainder of the flow would pass to the subregional system. It is even foreseeable that new, advanced treatment plants could be economical at the center of an area with a high reclaimed water demand.

Although the recommended interceptor is only proposed as far north as the city of Napa it is conceivable that further extensions may be necessary in the future for the Yountville, St. Helena, or Calistoga areas.

However, with the potential in these areas for agricultural reuse it is to be hoped that such an extension is not necessary. The demand for water for irrigation and perhaps frost protection, together with the possibilities for land disposal treatment of excess wastewaters, should supply the northern valley with a more beneficial and economical answer to the wastewater problem than interceptor transport to the south. There are several studies underway at present in the area, including one on oxidation pond treatment and another on the possible use of wastewater for frost protection. These studies will hopefully provide the best solutions for the upper valley area.

Solano County Subregion

It is not anticipated that the population growth in this subregion in the next 20 years will significantly alter the recommended short-range course of wastewater planning in the future. Open land will still predominate and it is to this land that the growing, but isolated, communities are still expected to turn for wastewater disposal. Although some areas are affected by a higher-than-average dissolved solids content in their wastewaters it is hoped that economical treatment methods will be found to enable a combination of land irrigation and land disposal to provide the long-range wastewater solution for the subregion. An extensive need for irrigation water must make the recycling of advanced treated wastewater an attractive proposition. The necessary backup safeguard should be most economically found in land disposal treatment or in stabilization ponds because of the abundance of available land.

Coastal Subregion

The main growth in this subregion will naturally occur along the San Mateo County coastline but accelerating increases can be expected in Marin and Sonoma counties.

With the short-range solution being found in the recommended consolidations into three controlling entities, the San Mateo County portion of this coastal subregion can be expected to resolve its future planning within the same framework. With its presently intended program of outfall extension, treatment plant upgrading, and wastewater reclamation within the next five years, the North San Mateo County Sanitation District would be well on the way to a long-range control of wastewaters. Increases in wastewater recycling for irrigation of the large area of parks and cemeteries in the district can be expected to offset the predicted small increases in flow over the next 20 years. Long-range wastewater planning will therefore be concerned with possible upgrading of treatment or further outfall extensions to meet updated water quality criteria.

The City of Pacifica has a wastewater plan which would constitute a viable section of subregional wastewater planning for the next 20 years. With the intended immediate consolidation of its two existing plants and discharge by way of a deep ocean outfall, the City has a sound base on which to develop. Extension to secondary treatment when dictated by water quality requirements will be the basis of the long-range plan. Possible uses for reclaimed wastewater are limited in the immediate future. Any change in this situation would lead to incorporation of advanced treatment in the long-range planning.

The short-range program consolidation of Half Moon Bay with the Montara and Granada Sanitary Districts would provide the framework for future planning in this area. Continued upgrading of the joint treatment facilities, together with a deep water outfall, would appear to offer the most economical direction for the group to progress. There will undoubtedly be a demand for irrigation water in the area. The extent of this demand and the possibility of meeting it with reclaimed wastewater must form part of any future planning.

Although the population in the Marin and Sonoma portion of this subregion will accelerate quite rapidly in the next 20 years the communities within that portion will still remain small and isolated. Those that provide sewage collection must treat and dispose as individual entities with the possible exception of the Bolinas-Stinson Beach area. Where household disposal is impractical communities must plan to protect the environment by a combination of treatment and ocean disposal. It is important that development along these coastal areas does not proceed without adequate safeguards for the control of wastewater pollution. Planning must be such that adequate steps are taken before the ecology of the area is affected and not left until the first signs of damage are in evidence.

Sonoma County Subregion

The recently implemented treatment consolidation of Rohnert Park and Cotati and that planned for Santa Rosa and Sebastopol provide the first step in the subregional solution to wastewater problems. Following the short-range recommendation for a single facility for these communities at Santa Rosa's Laguna plant, further consolidations of communities in the central plains would appear to offer the most practical and economical solution to achieve the high degree of treatment necessary to maintain water quality standards in the area. Possible consolidations indicate combined facilities at the proposed county airport plant for the central area and at Forestville for the Green Valley-Atascadero area. Future investigations may, of course, recommend wider consolidations and better locations.

With a strict limitation of available receiving waters for wastewater effluent, continued advances in the degree of treatment required will be unavoidable. Advanced treatment at small plants is disproportionately expensive and even for this reason alone joint facilities must be considered. Future reuse of wastewater for irrigation must also be considered in future planning, both for the benefit to the land and for the reduction in effluent flow. The city of Healdsburg has a new plant under construction at present which should serve its needs for the immediate future. However, possible future consolidation at the county airport plant for future treatment could prove an economical advantage in meeting future standards.

The city of Cloverdale and the other small communities in the north are of a size and isolation as to seemingly preclude any mutual action on the wastewater problem. High degrees of treatment with maximization of irrigational reuse and land disposal would appear to be the best basis for long-range planning.

South Santa Clara County Subregion

With a high predicted growth and a low present development this subregion has the capability to plan immediately for subregionalized treatment facilities. The two existing sewered communities of Morgan Hill and Gilroy already share the same plant. Although the present interceptor is not sized to accept presently unsewered areas in the subregion, the answer would appear to be a new north-to-south line capable of transporting all flows from all portions to a joint plant at Gilroy. This was the recommended short-range program for the area but the timing of this will depend on whether the growth in the area is as fast as predicted. The subregional interceptor and treatment plant should be constructed before each individual community proceeds with its own system. Wastewater planning must take into consideration the lack of adequate receiving waters in the area for the wastewater effluents likely in the future. The construction of a subregional interceptor and treatment plant before the predicted development in the area offers an obvious economic advantage. Expansion of the Gilroy plant to subregional capacity would not decrease the degree of treatment to be provided but would enable it to be achieved at lower cost and better efficiency.

Continued long-range planning for the area, consequent on subregionalizing treatment facilities, would be concerned with upgrading treatment as necessary and developing and meeting a demand for the wastewater reuse.

Summary of Long-Range Plan

The recommended long-range plan follows the achievements of the short-range program of providing for effluent discharge to areas of high assimilative capacity by upgrading the effectiveness of treatment and maximizing the recycling of wastewater.

To enhance the quality of the environment, wastewater treatment must continue to advance in the areas of specific constituent removal, such as toxicity and nutrient removal, as well as in the established parameters of BOD and solids. Pollution from wet weather flows must also be overcome. It is suggested in the long-range plan that such advanced treatment is best suited to large plants, both for economy and efficiency, and in many areas consolidation or subregionalization of facilities is recommended.

A high percentage of wastewater reuse is recommended in the plan. It is considered that this can best be accomplished at the local level. The plan therefore envisages a continued operation of local plants providing the high degree of treatment necessary for reuse for a flow consistent with the demand for wastewater reclamation in that area. Excess flow from these communities together with the total flow from those areas with no reuse potential would pass to the subregional plant for treatment and continued deep water disposal.

Sewer Planning

The major portion of sewer improvement work is intra-agency and as such does not affect regional planning to the same extent as wastewater disposal. This work includes such items as the provision of trunk lines to new land developments; replacements due to increased flows or pipe deterioration, rerouting to suit street and highway development, and the installation of trunk lines for better collection from established areas. These projects represent the normal activity of any sewerage agency and therefore require no elaboration. Proposed projects in this category are listed in Table 23 (page 149) as received from the agency concerned.

There is one part of sewer improvement work, however, which does have a regionwide impact. This is in the elimination of infiltration. As previously stated, communities are reporting wet weather flows varying from 20 percent to 1000 percent above dry weather flow. Existing treatment facilities are not designed to handle this latter type of increase, with the result that overflows of raw sewage occur from these plants during wet weather. The resulting pollution of the waterways makes this a regional problem. An item of high priority in sewer planning, therefore, is a concerted effort to reduce present infiltration rates. Whether this is best accomplished by a comprehensive sewer sealing program or by complete replacement of old lines, will depend on local conditions. The problem of infiltration cannot always be attributed to old sewers. Inadequate supervision of new line installations, particularly of house connections--together with poor construction techniques and standards--is a major cause of infiltration. Unless such deficiencies are remedied and high standards are maintained in the future, little progress in reducing infiltration rates can be made. The recommended wastewater plan calls for effluent interceptors, consolidated outfalls, and, in some cases, joint treatment plants. Unless wet weather flows in many areas can be reduced drastically, the economic disadvantage of sizing these facilities for present storm flows is distressingly obvious. Any program for the reduction of stormwater infiltration into sewers must stand high on the list of priority items in the sewerage planning in the region.

The implementation of the recommended wastewater plan may necessitate trunk sewer construction in some areas. Although it is impossible to list such projects at this time, they will naturally form part of the regional sewerage plan.

Proposed Sewerage Projects

The sewerage projects listed in Table 23 (page 149) form the basis of the regional short-range program and long-range plan. Further inputs can, and will, be made in the future as regional water resources planning advances.

It would not be practical to attempt to list every project each agency is planning for the future. The intended work has therefore been grouped according to general type, and the estimated cost for that work has been totalled for each group.

Table 13

EXISTING SEWERAGE FACILITIES, ALAMEDA COUNTY

Agency	Estimated Population 1970	Sewage Flow, mgd		Type of Plant	Point of Effluent Disposal
		Present	Design Capacity		
Alameda	83,000			See EBMUD No. 1	
Albany	17,600			See EBMUD No. 1	
Berkeley				See EBMUD No. 1	
Castro Valley Sanitary District	50,000	3		See Oro Loma Sanitary District	
East Bay Municipal Utility District (EBMUD Special District No. 1)	564,575	71	128	Primary with chlorination	San Francisco Bay
Emeryville	3,000			See EBMUD No. 1	
Hayward	97,500	12.34	18	Trickling filter - activated sludge - aerated ponds	San Francisco Bay
Livermore	35,500	3.6	5	Secondary with chlorination	Arroyo Las Positas (stream)
Oakland	357,190	49.5		See EBMUD No. 1	
Oro Loma Sanitary District	120,000	12	100	Secondary with chlorination	San Francisco Bay
Piedmont	11,500	1		See EBMUD No. 1	San Francisco Bay

Table 13 (Continued)

Agency	Estimated Population 1970	Sewage Flow, mgd		Type of Plant	Point of Effluent Disposal
		Present	Design Capacity		
Pleasanton	20,000	1	1.7	Secondary	(Land)
San Leandro	48,000	8.5	20	Secondary with chlorination	San Francisco Bay
Union Sanitary District	150,000				
Newark		4.82	7.0	Secondary with chlorination	Newark Slough
Irvington		5.00	10.5	Secondary	Mud Slough
Alvarado		1.83	3.0	Secondary with chlorination	Alameda Creek
Valley Community Service District	30,000	2.308	2.5	Secondary with chlorination	Alamo Canal

Table 14

EXISTING SEWERAGE FACILITIES, CONTRA COSTA COUNTY

Agency	Estimated Population 1970	Sewage Flow, mgd		Type of Plant	Point of Effluent Disposal
		Present	Design Capacity		
Antioch	28,200	2.01	2.5		
Bella Vista Sanitary District	3,000			See Sanitation District No. 7-A.	
Brentwood	2,800	0.4	Unknown	Secondary	(Land)
Byron Sanitary District	NIR				
Central Contra Costa County Sanitary District	275,000	24.7	31	Primary with chlorination	Suisun Bay
Concord	91,000(1)	5.05	6.2	Tertiary with chlorination	Walnut Creek
Contra Costa County Sanitation District No. 3	12,000	1.0	0.6	Primary	San Pablo Bay
Contra Costa County Sanitation District No. 5	294	0.04	0.05	Primary	Carquinez Strait

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(1) Part of flow to Central Contra Costa County Sanitary District.

Table 14 (Continued)

Agency	Estimated Population 1970	Sewage Flow, mgd		Type of Plant	Point of Effluent Disposal
		Present	Design Capacity		
Contra Costa County Sanitation District No. 7-A	11,000	0.8	0.4	Primary	Suisun Bay
Contra Costa County Sanitation District No. 7-B	50-60	0.06		See Sanitation District No. 7-A.	
Crockett Valona Sanitary District	5,000	.138	.55	Primary	Carquinez Strait
Hercules	300	0.03		(Septic tank disposal)	
Mt. View Sanitary District	11,000	0.80	1.6	Secondary with chlorination	Peyton Slough
Oakley Sanitary District	NIR				
Pinole	13,100	.9	1.1	Primary	San Pablo Bay
Pittsburg					
Montezuma STP	16,000	1.5	3.5	Primary with chlorination	New York Slough West Reach
Camp Stoneman STP	8,000	.6	7.5	Secondary	New York Slough East Reach

Table 14 (Continued)

Agency	Estimated Population 1970	Sewage Flow, mgd		Type of Plant	Point of Effluent Disposal
		Present	Design Capacity		
Richmond Municipal Sanitary District	78,016	8.5/9	16	Secondary with chlorination	San Francisco Bay
Rodeo Sanitary District	7,500	0.60	0.84	Primary	San Pablo Bay
San Pablo Sanitary District	80,000	7.35	7.8	Primary with chlorination	San Pablo Bay
Stege Sanitary (2) District	46,000	4.35	5.00	Primary	San Francisco Bay

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(2) Annexed by EBMUD 1971.

Table 15

EXISTING SEWERAGE FACILITIES, MARIN COUNTY

Agency	Estimated Population 1970	Sewage Flow, mgd		Type of Plant	Point of Effluent Disposal
		Present	Design Capacity		
Almonte Sanitary District	1,900			See Mill Valley	
Alto Sanitary District	1,050	0.06		See Mill Valley	
Belvedere	2,600	0.225		See Sanitary District No. 5	
Bolinas Community Public Utility District	580	0.040	0	None	None
Homestead Valley Sanitary District	2,694	0.25		See Mill Valley	
Larkspur Sanitary District	10,000	0.7		See Sanitary District No. 1	
Las Gallinas Valley Sanitary District	4,600	2.12	2.25	Secondary	San Pablo Bay
Mill Valley	12,000	1.5	1.7	Secondary with chlorination	Richardson Bay

Table 15 (Continued)

Agency	Estimated Population 1970	Sewage Flow, mgd Present	Sewage Flow, mgd Design Capacity	Type of Plant	Point of Effluent Disposal
Richardson Bay Sanitary District	12,000	0.70	0.4	Secondary with chlorination	Richardson Bay
San Rafael	24,000	2.8		See San Rafael Sanitation District	
Sanitary District No. 1 of Marin County	50,000	5.9	5.0	Secondary with 90-day ponding	San Francisco Bay
Sanitary District No. 2 of Marin County	10,000	1.33		See Sanitary District No. 1	
Sanitary District No. 5 of Marin County	6,000	0.675	1.6	Primary with chlorination	San Francisco Bay
Sanitary District No. 6 of Marin County	34,400	3.3	3.6	Secondary with chlorination	Novato Creek
San Rafael Sanitation District	25,000	2.5	5.0	Secondary with chlorination	San Francisco Bay
Sausalito	6,700			See Sausalito-Marin City Sanitary District	

Table 15 (Continued)

Agency	Estimated Population 1970	Sewage Flow, mgd		Type of Plant	Point of Effluent Disposal
		Present	Design Capacity		
Sausalito-Marin City Sanitary District	13,000	1.8	6.9	Primary with chlorination	San Francisco Bay
Tamalpais Valley Sanitary District	NIR[1]				

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[1] No information received.

Table 16

EXISTING SEWERAGE FACILITIES, NAPA COUNTY

Agency	Estimated Population 1970	Sewage Flow, mgd		Type of Plant	Point of Effluent Disposal
		Present	Design Capacity		
American Canyon County Water District	4,000	0.3	0.45	Secondary	Slough unknown
Calistoga	1,800	0.365	0.5	Secondary with 30-day ponding	Napa River
Napa Sanitation District	45,000	5.9	11	Raw sewage lagoons with chlorination and 90-day ponding	Napa River
St. Helena	2,200	0.4	0.5	Secondary with 90-day ponding	Napa River
Veterans Home of California	2,200	.31	1.50	Secondary with chlorination	Napa River
Yountville	1,000	0.08	0.125	Secondary with chlorination	Napa River

Table 17

EXISTING SEWERAGE FACILITIES, SAN FRANCISCO COUNTY

Agency	Estimated Population 1970	Sewage Flow, mgd Present	Sewage Flow, mgd Design Capacity	Type of Plant	Point of Effluent Disposal
City and County of San Francisco					
Richmond-Sunset TP and Drainage District	220,000	21.8	30.0	Primary with chlorination	Ocean
North Point TP and Drainage District	370,000	67.4	65	Primary with chlorination	Ocean via San Francisco
Golden Gate Park Plant	11,000	0.9	1.0	Secondary with chlorination	Elk, Stow, Mallard, Metson, South, Middle North Lakes
Southeast TP and Drainage District	160,000	18.7	70.0	Primary with chlorination	Ocean via San Francisco Bay

Table 18

EXISTING SEWERAGE FACILITIES, SAN MATEO COUNTY

Agency	Estimated Population 1970	Sewage Flow, mgd		Type of Plant	Point of Effluent Disposal
		Present	Design Capacity		
Atherton				See Menlo Park Sanitary District	
Bayshore Sanitary District	3,430	1.0		See San Francisco Southeast	
Belmont	23,000	4.0		See San Carlos	
Brisbane	5,000	0.15		See Guadalupe Valley M.I.D.	
Burlingame	34,200	4.73	9.7	Tertiary with chlorination	San Francisco Bay
East Palo Alto Sanitary District	20,000	1.63		See City of Palo Alto	
Estero Municipal Improvement District	10,000	0.9	2.16	Primary	San Francisco Bay
Granada Sanitary District	2,700	0.117	0.3	Primary with chlorination	Ocean

Table 18 (Continued)

Agency	Estimated Population 1970	Sewage Flow, mgd		Type of Plant	Point of Effluent Disposal
		Present	Design Capacity		
Guadalupe Valley Municipal Improvement District	--	0.16	2.0	Primary with chlorination	San Francisco Bay
Half Moon Bay	4,200	0.29		Primary with chlorination	Ocean
Hillsborough	8,800	0.88		See San Mateo	
Menlo Park Sanitary District	55,000	5.8	8.0	Secondary with chlorination	San Francisco Bay
Millbrae	22,000	2.2	5.3	Secondary with chlorination	San Francisco Bay
Montara Sanitary District	2,800	0.25	0.5	Secondary	Ocean
North San Mateo County Sanitation District	80,000	3.8	12	Primary	Ocean
Pacifica					
Sharp Park	19,000	1.6	4.0	Primary with chlorination	Ocean
Linda Mar	23,000	2.5	4.0	Primary with chlorination	Ocean

Table 18 (Continued)

Agency	Estimated Population 1970	Sewage Flow, mgd		Type of Plant	Point of Effluent Disposal
		Present	Design Capacity		
Redwood City	85,000	7.5	8.5	Secondary with chlorination [1]	Redwood Creek to San Francisco Bay
San Bruno	39,100	2.7		See South San Francisco	
San Carlos	27,000	5.0	11.0	Secondary with chlorination [1]	Steinberger Slough
City and County of San Francisco-Public Utilities Commission-San Francisco International Airport		0.85	0.75	Primary with chlorination	San Francisco Bay
San Mateo	110,000	10	10.0	Primary with chlorination	San Francisco Bay
South San Francisco	85,000	8.0	13.0	Secondary with chlorination	San Francisco Bay
City and County of San Francisco-County Jail	600 to 900	0.25	0.15	Secondary with chlorination	Re-use for irrigation
Woodside				See Redwood City	

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[1] New construction underway.

Table 19

EXISTING SEWERAGE FACILITIES, SANTA CLARA COUNTY

Agency	Estimated Population 1970	Sewage Flow, mgd		Type of Plant	Point of Effluent Disposal
		Present	Design Capacity		
County Sanitation District No. 2	10,000	1.8		See San Jose	
County Sanitation District No. 3	4,500	0.40		See San Jose	
County Sanitation District No. 4	123,000	10.4		See San Jose	
Cupertino Sanitary District	30,000	2.286		See San Jose	
Gilroy	12,699	3.2		Primary	Percolation ponds
Los Altos	27,500	1.92	6.0	Primary	South San Francisco Bay
Los Altos Hills	6,850			Septic Tanks	
Los Encinos Sanitary District	NIR (1)				
Los Gatos	21,850	2.02		See San Jose	

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(1) No information received.

EXPLANATORY NOTE TO TABLE 22

In Table 22 all of the short-range plans reported by the agencies are tabulated. Some of the projects listed do not conform to the recommended plan but are considered acceptable alternatives if the subregion involved decides to proceed along a different course. Other projects are considered to be of a temporary nature in that improvements may be needed now but such work may be rendered obsolete by the adoption of the proposed plan. These improvements therefore should be made for a "short-life." Still other projects listed by the agencies do not conform to the recommended plan and are not considered in the best interests of wastewater planning for the area, and thus should only be constructed if for a definite reclamation and reuse demand.

The following legend was adopted to indicate the above qualifications:

(a) Conforms to recommended plan but timing may be altered and/or extent of project varied if plan is implemented.

(b) Not in conformance with recommended plan but may be an acceptable alternative.

(c) Considered "temporary" improvement until planning finalized.

(d) Not in conformance with recommended plan and not considered warranted unless for a specific reclamation project.

Table 22

SHORT-RANGE WASTEWATER TREATMENT FACILITIES PROJECTS

Agency	Description of Project	Capital Cost Estimate
Alameda County		
East Bay Municipal Utility District	1970 - Sludge disposal facility.	$ 450,000
	1972 - Upgrade treatment facilities.	48,000,000
	1972+ - Treatment of overflows.	13,700,000
Hayward	(c) 1970 - Operations building, chlorination and sludge thickener.	650,000
	(b) 1975 - Additional secondary treatment.	3,800,000
	(d) 1980 - Deep water outfall and pump stations.	No estimate
Livermore	1970-72 - Water reclamation expansion.	230,000
	(a) 1973 - Same as above.	1,440,000
	(a) 1974 - Same as above.	1,440,000
	(a) 1975-80 - Same as above.	1,500,000
Oro Loma Sanitary District	Now completing a 28-mgd secondary treatment plant (activated sludge) - by 1/71.	
Pleasanton	Plan to phase-out existing plant and join Valley Community Service District - estimated cost of buying-in.	1,600,000
San Leandro	(a) 1972 - Sedimentation tanks, secondary clarifier, aeration, incineration, reclamation.	2,000,000
	(d) 1977 - Outfall extension.	1,000,000

Table 22 (Continued)

Agency	Description of Project	Capital Cost Estimate
Alameda County		
Union Sanitary District	1972 - Extensions to Newark plant.	$ 1,500,000
	(a) 1972 - Extension to Irvington plant.	2,250,000
	1973 - Extension to Alvarado plant.	600,000
Valley Community Service District	1971 - Stage 2 plant expansion.	1,100,000
	(b) 1975 - Stage 3 plant expansion.	2,800,000
	(b) 1979 - Stage 4 plant expansion.	4,900,000
Contra Costa County		
Antioch	(d) 1971 - Improve inlet facility.	120,000
	(d) 1976 - Double capacity to secondary.	780,000
Brentwood Sanitary District	NIR.(1)	
Byron Sanitary District	NIR.	
Central Contra Costa Sanitary District	1971 - Stormflow retention.	550,000
	(a) 1972 - Extension to primary treatment plant.	2,150,000
	(a) 1973-74 - Secondary treatment.	14,650,000
	(a) 1974 - Pump stations (Suggested site for subregional plant).	580,000
Contra Costa County Sanitation District No. 5	(d) 1980 - Install package treatment plant (secondary treatment).	50,000

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(1) No information received.

Table 22 (Continued)

Agency	Description of Project	Capital Cost Estimate
Contra Costa County		
Contra Costa County Sanitation District No. 7A and 7B	(d) 1972 - Expansion to secondary treatment.	$ 1,000,000
Contra Costa County Sanitation District No. 15	(d) 1975 - New treatment plant (and sewers).	3,740,000
Concord	(d) 1971 - Secondary treatment plant improvements.	40,000
Crockett - Valona Sanitary District	(d) 1971 - Secondary treatment and chlorination.	650,000
Hercules	No present plans.	
Mountain View Sanitary District	(c) 1975 - Sludge facilities (disposal).	100,000
	(d) 1980 - Plant expansions.	500,000
Oakley Sanitary District	NIR.	
Pinole	(d) 1971 - Expansion of secondary treatment plant and addition of secondary treatment.	1,520,000
Pittsburg	(d) 1970-73 - Treatment plant extensions.	200,000
	(d) 1974 - Sludge incinerator.	150,000
Richmond	No deficiencies reported (suggested site for subregional plant).	

Table 22 (Continued)

Agency	Description of Project	Capital Cost Estimate
Contra Costa County		
San Pablo Sanitary District (now including Sanitation District No. 3)	(c) 1970 - Additions to plant for higher flows, wet weather flows.	$ 4,800,000
	(d) 1970 - Secondary treatment.	
	(d) 1975 - Possible outfall construction.	No estimate
Marin County		
Bolinas Community Public Utility District	1971 - New sewage treatment plant with aerated lagoons, chlorination, and deep water outfall.	780,000
Las Gallinas Valley Sanitary District	(d) 1971 - Enlarge secondary treatment plant - sludge thickener and chlorination.	250,000
	1973 - Reclamation facilities.	140,000
	1978 - Enlarge reclamation facility.	125,000
Marin County Sanitary District No. 1 (San Anselmo)	NIR.	
Marin County Sanitary District No. 5 (Tiburon)	(b) 1971-72 - Plant expansions.	900,000
Marin County Sanitary District No. 6 (Novato)	(d) 1971 - Improvements to Novato and Ignacio plants plus consolidated new outfall.	3,630,000
	(d) 1971+ - Improvements to Bahia plant until phase-out and transport to Novato plant.	70,000/yr

Table 22 (Continued)

Agency	Description of Project	Capital Cost Estimate
Marin County		
Mill Valley	(b) 1973 - Treatment plant extensions.	$ 2,000,000
Richardson Bay Sanitary District	(d) 1972 - Enlarge secondary treatment plant (Trestle Glen plant).	300,000
San Rafael Sanitation District	(a) 1971 - New sewage pump stations.	500,000
	(d) 1971 - New outfall at Marin Bay treatment plant.	80,000
	(d) 1972 - New deeper outfall at Main treatment plant.	400,000
	(b) 1972+ - Expansion of Marin Bay treatment plant.	No estimate
Sausalito - Marin City Sanitary District	(b) 1971 - Treatment plant improvements.	250,000
	(b) 1975 - Treatment plant enlargements.	1,000,000
Tamalpais Valley Sanitary District	NIR.	
Napa County		
American Canyon Water District	(c) 1971 - Clarifier digester and chlorination.	1,800,000
Calistoga	1971-73 - Pumps, ponds, chlorination, outfall.	330,000
	1974-5 - Pumps and outfalls of digester improvements.	200,000

Table 22 (Continued)

Agency	Description of Project	Capital Cost Estimate
Napa County		
Napa Sanitation District	No deficiencies reported.	$
St. Helena	No deficiencies reported.	
Yountville	NIR.	
San Francisco County		
	1970-75 - Miscellaneous dry weather flow improvements as required.	10,500,000
	1971+ - Wet weather flow improvements.	30,000,000
North Point Plant	1970-72+ - Outfall and pumping.	6,800,000
	Macroscopic removal.	2,000,000
	Chlorination.	400,000
	Turbidity, grease removal.	400,000
	Miscellaneous studies.	1,400,000
	Miscellaneous projects.	2,000,000
		13,000,000
Richmond-Sunset Plant	1970-72+ - Macroscopic removal.	2,000,000
	Outfall relocation and extension.	3,500,000
	Chlorination and chemicals.	250,000
	Sludge control.	400,000
	Miscellaneous.	850,000
		7,000,000
South-East Plant	1970-72+ - Macroscopic removal.	1,000,000
	Chlorination and chemicals.	400,000
	Sludge handling.	500,000

Table 22 (Continued)

Agency	Description of Project	Capital Cost Estimate
San Francisco County		
	Toxicity studies.	$ 200,000
	Odor control.	250,000
	Pumping (effluent system).	100,000
	Miscellaneous projects.	2,000,000
		4,550,000
San Mateo County		
Bayshore Sanitary District	NIR.	
Belmont	(a) 1978 - New secondary treatment plant with Redwood City and San Carlos.	1,500,000
Burlingame	1972 - Reclamation for park irrigation.	No estimate
	(d) 1973 - Outfall improvements.	5,000
Estero Municipal Improvement District	(b) 1971 - Expand primary treatment.	190,000
	(d) 1978 - Same as above.	190,000
Granada Sanitary District	NIR.	
Guadalupe Valley Municipal Improvement District	NIR.	

Table 22 (Continued)

Agency	Description of Project	Capital Cost Estimate
San Mateo County		
Half Moon Bay	1971 (Result of existing study) - Plant expansion and secondary treatment or consolidation with Sanitary Districts.	No estimate
Menlo Park Sanitary District	(b) 1975 - Aeration equipment for oxidation ponds.	$ 200,000
Millbrae	(d) 1972 - Standby power at treatment plant.	25,000
Montara Sanitary District	NIR.	
North San Mateo County Sanitation District	1971 - Lake Merced outfall.	100,000
	1972 - Extension to treatment plant and reclamation facilities.	3,500,000
Pacifica	1971 - Consolidated primary treatment with deep ocean outfall.	4,000,000
Redwood City	1970 (Present) - Pumping and treatment plant addition.	700,000
	(a) 1978 - Consolidated wastewater treatment plant with Belmont-San Carlos.	4,500,000
San Bruno	To South San Francisco plant.	
San Carlos	1970 (Under construction) - Treatment plant additions.	100,000
	(a) 1978 - Consolidated treatment plant with Belmong and Redwood City.	2,700,000

Table 22 (Continued)

Agency	Description of Project	Capital Cost Estimate
San Mateo County		
San Francisco International Airport	1975 - Industrial waste treatment plant to replace existing oxidation ponds.	$ 4,100,000
	New secondary plant being built for 1971 (sewage).	Funded
San Mateo	(a) 1972 - Secondary treatment.	2,900,000
	(a) 1973 - Partial tertiary treatment.	600,000
South San Francisco	Depends on present study.	
	(b) 1971 - Treatment and disposal improvements.	3,500,000
	1975 - Reclamation facilities.	No estimate
Santa Clara County		
Gilroy	1971-75 - Convert percolation ponds to lagoons.	10,000 to 20,000/yr
	1973-74 - Construct secondary plant.	19,700,000
Los Altos	Subregional treatment plant with Palo Alto and Mountain View by 1971.	
Milpitas Sanitary District	(d) 1971-72 - Treatment plant expansion.	750,000
	(d) 1973-75 - Treatment plant improvements.	40,000
Morgan Hill	To Gilroy plant.	

Table 22 (Continued)

Agency	Description of Project	Capital Cost Estimate
Santa Clara County		
Mountain View	1970 - Pump station and force main.	$ 460,000
	1970 - Subregional treatment plant at Palo Alto (Mountain View's share of $10,560,000).	4,100,000
Palo Alto	1971 - Subregional treatment plant.	10,560,000(2)
	(b) 1971 - STP additions.	15,000
	(b) 1973 - Same as above.	25,000
	(b) 1974 - Same as above.	35,000
San Jose	(a) 1971 - Extension to plant and secondary treatment.	22,300,000
Sunnyvale	Nothing planned until South Bay report completed.	
Solano County		
Benecia	No deficiencies reported.	
Dixon	No deficiencies reported.	
Fairfield	1970 - Cordelia sewage treatment plant.	240,000
Fairfield-Suisun Sanitary District	NIR.	
Rio Vista	NIR.	
Vacaville	1980 - Expand Easterly sewage treatment plant.	1,000,000

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(2) To be shared with Mountain View and Los Altos.

Table 22 (Continued)

Agency	Description of Project	Capital Cost Estimate
Solano County		
Vallejo Sanitary and Flood Control District	(b) 1974 - Treatment plant expansion to 20 mgd and secondary treatment.	$ 9,000,000
Sonoma County		
Cloverdale	NIR.	
Cotati	Now to Rohnert Park plant.	
County Airport	1973-74 - Aeration lagoons and holding ponds.	3,800,000
Healdsburg	1970-1 - New secondary treatment plant under construction with pump station and interceptors.	1,600,000
	1973-75 - Interceptor.	400,000
	1975-80 - Same as above.	300,000
Petaluma	(b) 1972 - Stage II additions to treatment plant.	3,630,000
Rohnert Park	NIR.	
Santa Rosa	(a) 1973 - Laguna plant expansion.	2,500,000
	(a) 1973 - Llano interceptors.	1,500,000
Sebastopol	NIR.	
Sonoma Valley County Sanitary District	(a) 1971 - Stormwater detention ponds and chlorination.	400,000
	(b) 1975 - Expand activated sludge to 4-mgd.	800,000
	(d) 1977 - Parallel 54-inch and outfall.	750,000

Table 23

SHORT-RANGE SEWERAGE PROJECTS

Agency	Description of Project	Capital Cost Estimate
Alameda County		
Alameda(1)	None.	$
Albany (1)	1975 - Replace old facilities.	1,000,000*
Berkeley (1)	None.	
Castro Valley Sanitary District	1971-72 - General improvements (14,000 ft).	No cost given*
Emeryville(1)	1970 - New collection facilities.	30,000
	1971 - Same as above.	100,000
	1972 - Same as above.	100,000
	1973 - Same as above.	70,000
	1970-75 - Upgrade old sewers.	100,000*
Hayward	1972 - Central city sewer interceptor.	2,000,000
Livermore	1970-71 - Sewer line installation.	130,000
	1971-72 - Same as above.	278,000
	1972-73 - Same as above.	95,000
	1973-74 - Same as above.	148,000
	1974-75 - Same as above.	920,000
	1975-76 - Same as above.	1,400,000
	1976-80 - Same as above.	1,500,000
Oakland(1)	1970-71 - Expansion of collection system.	750,000
	1970-71 - Replacement of old facilities.	1,250,000*

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(1) East Bay cities (Alameda, Albany, Berkeley, Emeryville, Oakland, Piedmont) sewer improvements to correct stormwater overflows, $24,500,000.

* Remedial project.

Table 23 (Continued)

Agency	Description of Project	Capital Cost Estimate
Alameda County		
	1971-72 - Expansion of collection system.	$ 250,000
	1971-72 - Replacement of old facilities.	750,000*
	1972-73 - Same as above.	750,000*
	1973-74 - Same as above.	750,000*
	1974-75 - Same as above.	750,000*
	1975-76 - Same as above.	750,000*
	1976-77 - Same as above.	750,000*
Oro Loma Sanitary District	1971 - Saddle Drive sewer replacement.	30,000*
	1975 - Trojan Ave. pump station replacement.	200,000*
	1975 - In-district sewer trunk line and improvements.	200,000*
Piedmont(1)	1970-80 - Sewer improvements.	70,000/yr*
Pleasanton	No projects planned until after results of present study.	
San Leandro	1971 - First-stage sewer system improvements.	350,000*
	By 1980 - Second-stage sewer system improvements.	800,000*
Union Sanitary District	1971 - Miscellaneous trunk sewer system extensions.	154,000
	1972 - Same as above.	32,000

Table 23 (Continued)

Agency	Description of Project	Capital Cost Estimate
Alameda County		
	1973 - Miscellaneous trunk sewer system extensions.	$ 893,000
	1974 - Same as above.	26,000
	1975 - Same as above.	128,000
Valley Community Services District	None.	
Contra Costa County		
Antioch	None.	
Brentwood	NIR.(3)	
Byron Sanitary District	NIR.	
Central Contra Costa County Sanitary District	None.	
Concord	1971 - Relief sewer.	50,000*
Contra Costa County Sanitation District No. 3	1971 - Convert treatment plant to a pump station and construct transport sewer line to San Pablo Sanitary District's interceptor.	700,000
Contra Costa County Sanitation District Nos. 5, 7A, 7B	None.	

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(2) Information received--no projects.
(3) No information received.

Table 23 (Continued)

Agency	Description of Project	Capital Cost Estimate
Contra Costa County		
Contra Costa County Sanitation District No. 15	1975 - New sewers for whole service area.	Indeterminate
Crockett Valona Sanitary District	NIR.	$
Hercules	1972-78 - Sewer collection system, pump stations, etc.	750,000
Mountain View Sanitary District	None.	
Oakley Sanitary District	NIR.	
Pinole	None.	
Pittsburg	None.	
Richmond Municipal Sanitary District	1970 - Sewer reconstruction.	50,000*
	1970-72 - Sewer reconstruction.	80,000*
	1972 - Sewer reconstruction.	90,000*
	1973 - Sewer reconstruction.	75,000*
	Annually - infiltration study.	2,000 to 6,000/yr
Rodeo Sanitary District	NIR.	

Table 23 (Continued)

Agency	Description of Project	Capital Cost Estimate
Contra Costa County		
San Pablo Sanitary District	1970 - Trunk sewer improvements.	$ 2,958,000*
	1971 - Tara Hills trunk line.	700,000
Stege Sanitary District	1970 - Force mains, pipelines, pump station to connect to EBMUD interceptor.	1,600,000
Marin County		
Almonte Sanitary District	General maintenance and elimination of storm water infiltration.	4,000/yr*
Alto Sanitary District	None.	
Belvedere	Continuous maintenance, repair and replacement.	Indeterminate*
Bolinas Community Public Utility District	1971 - Rehabilitation of existing sewers, new collection system for unsewered area, interception of existing raw sewage discharge at new pump station, new force mains and gravity interceptors to new treatment plant.	2,162,000
County Sewer Maintenance District (Kay Park)	1973-74 - Major reconstructions to eliminate infiltration.	Indeterminate*

Table 23 (Continued)

Agency	Description of Project	Capital Cost Estimate
Marin County		
County Sewer Maintenance District (Murray Park)	None.	$
Homestead Valley Sanitary District	Upgrade existing systems.	Indeterminate*
Larkspur	1971 - Upgrading of main trunk lines and pumping.	500,000*
Las Gallinas Valley Sanitary District	1971 - Marinwood pumping station comminutor.	6,000
	1971 - Terra Linda pumping station enlargements.	20,000
	1972 - Mulligan pumping station enlargements.	26,000
	1975 - Enlarge force main.	70,000
	1975 - Marinwood pumping station enlargements.	25,000
Mill Valley	1970-80 - Upgrading of collector system at $40,000/yr.	400,000*
	1970 - Cascade Drive collector (new).	123,000
	1971 - Lower Camino Alto trunk (new).	90,000
	1971 - Golf course collector (new).	40,000
	1972 - Ashford Ave. collector (new).	50,000
	1973 - 5 new collectors (minor).	86,000

Table 23 (Continued)

Agency	Description of Project	Capital Cost Estimate
Marin County		
Richardson Bay Sanitary District	1970 - Bel Air sewer improvements.	$ 40,000*
	1972 - Trestle Glen interceptor.	250,000
San Rafael Sanitation District	1971 - Major reconstruction and upgrading of existing collection system.	500,000*
	1972 - Inspection, testing and sealing of balance of system not reconstructed.	600,000*
Sanitary District No. 1 of Marin County	NIR.	
Sanitary District No. 2 of Marin County	1970-71 - Rehabilitation work.	30,000*
	1971-72 - Same as above.	10,000*
	1972-73 - Same as above.	10,000*
	1973-74 - Same as above.	10,000*
	1974-75 - Same as above.	10,000*
Sanitary District No. 5 of Marin County	None.	
Sanitary District No. 6 of Marin County	1972 - New Olive St. pump station.	215,000
	1972 - Railroad Ave. force main.	90,000
	1972 - Main interceptor sewer No. 2 extension.	260,000
	1972 - Wilson Ave. interceptor sewer.	70,000

Table 23 (Continued)

Agency	Description of Project	Capital Cost Estimate
Marin County		
	1973 - Novato Blvd. trunk sewer No. 2.	$ 730,000
	1973 - South Novato Blvd. interceptor sewer.	60,000
Sausalito	1970-80 - Repair and replacement.	10,000/yr*
Sausalito-Marin City Sanitary District	No sewer projects reported.	
Tamalpais Valley Sanitary District	NIR.	
Napa County		
American Canyon County Water District	None.	
Calistoga	1970-71 - Replacement, cleaning and inspection.	22,000*
	1971-72 - Same as above.	49,000 *
	1972-73 - Replace various lines.	25,000 *
	1973-74 - Same as above.	81,000 *
	1974-75 - Same as above.	75,000 *
	1975-80 - Same as above.	150,000 *

Table 23 (Continued)

Agency	Description of Project	Capital Cost Estimate
Napa County		
Napa County Flood Control and Water Conservation District	None.	$
Napa Sanitation District	1975 - Sanitary sewer trunks.	420,000
	1980 - Two major sewage pump stations.	1,500,000
	1980 - Sanitary sewer trunks.	800,000
St. Helena	1971 - Scott Ave., Vineyard Ave. replacement.	45,000*
	1971 - South St. Helena Assessment District, including interceptor.	250,000
	1973 - Pratt Ave. trunk.	75,000
	1975 - Pope St. and Allison Ave. relief.	30,000
	1977 - Fulton Lane, Madrona Ave. trunk.	60,000
Yountville	NIR.	
San Francisco County		
City of San Francisco	1970-74 - Collection system repairs, extensions, renewals, etc.	3,000,000/yr*
	1971+ - Pump stations and interceptors.	1,000,000

Table 23 (Continued)

Agency	Description of Project	Capital Cost Estimate
San Mateo County		
Bayshore Sanitary District	1971 - New pump station and force main, which will include separation of storm and sanitary sewer.	$ 270,000
Belmont	1970 - Sealing existing sewer system.	21,560*
	1971 - Collection system, new sewer mains.	300,000
	1971 - New pump station for total city flow to existing sewage treatment plant and new force main.	411,650
	1971-75 - Trunk sewer and pump station additions.	1,500,000
Brisbane	NIR.	
Burlingame	1970 - Repair deteriorated mains.	15,000*
	1971 - Same as above.	25,000*
	1972 - Same as above.	25,000*
	1973 - Same as above and additional pump station.	50,000*
	1974-80 - Repair deteriorated mains.	40,000/yr*
Estero Municipal Improvement District	1972 - Sewage collection system for Neighborhood No. 5 - 132 acres of residential area.	410,000
	1973 - Sewage collection system for Neighborhood No. 6 - 125 acres of residential area.	405,000
	1974 - Sewage collection system for Neighborhood No. 7 - 293 acres of residential area.	706,000

Table 23 (Continued)

Agency	Description of Project	Capital Cost Estimate
San Mateo County		
	1974 - Sewerage collection system for approximately 125 acres of industrial park.	$ 400,000
	1978 - Sewerage collection system for approximately 125 acres of industrial park.	400,000
Granada Sanitary District	NIR.	
Guadalupe Valley Municipal Improvement District	None.	
Half Moon Bay	None.	
Hillsborough	None.	
Menlo Park Sanitary District	1971 - Alpine Road interceptor.	1,000,000
	1978 - El Camino Real to Bayshore Freeway trunk line.	3,000,000
Millbrae	1971-74 - Sewer mains replacement.	40,000/yr*
	1971 - Reconstruct Madrone St. sewage pump.	25,000*
	1971 - Replace Lomita force main.	30,000*
Montara Sanitary District	NIR.	

Table 23 (Continued)

Agency	Description of Project	Capital Cost Estimate
San Mateo County		
North San Mateo County Sanitation District	1971 - Colma trunk sewer.	$ 500,000
Pacifica	1971 - Construct main trunk sewer.	30,000
	1972 - Sealing of existing collection system to preclude infiltration.	300,000*
	1972 - Construct main trunk sewer.	60,000
Redwood City	None.	
San Bruno	NIR.	
San Carlos	None.	
City and County of San Francisco Airport Commission	1973 - Sewer main for airport system (replacement).	2,000,000*
San Mateo	1974 - South central trunk line.	300,000
	1971-80 - TV inspection and spot repairs.	35,000/yr*
	1973 - Trunk line 28th Ave.	190,000
South San Francisco	1971 - Pump stations and force main improvements.	450,000*
Colma	NIR.	
Atherton	NIR.	
Woodside	NIR.	

Table 23 (Continued)

Agency	Description of Project	Capital Cost Estimate
Santa Clara County		
County Sanitation District No. 2 of Santa Clara County	None.	$
County Sanitation District No. 3 of Santa Clara County	None.	
County Sanitation District No. 4 of Santa Clara County	1970-71 - Budd Ave. West and Forest-Rosa trunk sewers.	972,400
	1971-72 - Ross Creek and San Tomas Aquino Creek trunk sewers.	403,700
	1972-73 - Saratoga Ave. Unit B trunk sewer.	108,980
	1974-75 - San Tomas-Saratoga Creek trunk sewer.	115,050
	1976-77 - Moorpark-Saratoga trunk sewer.	58,020
	1977-78 - Quito Road Unit I trunk sewer.	91,330
	1978-79 - West Lexington Unit I trunk sewer.	255,460
	1979-80 - Los Gatos Creek Unit IV trunk sewer.	91,260
Cupertino Sanitary District	1975 - Additional line to S. J. - S.C. water pollution control plant.	2,000,000

Table 23 (Continued)

Agency	Description of Project	Capital Cost Estimate
Santa Clara County		
Gilroy	Various sewer trunk lines.	$ 10,000 to 20,000/yr
Los Altos	None.	
Los Altos Hills	None.	
Los Encinos Sanitary District	NIR.	
Los Gatos	None.	
Milpitas Sanitary District	1972-73 - New trunk and interceptor sewer for Central City area.	400,000
	1978 - New interceptor sewer in Abel St.	200,000
Morgan Hill	1971-75 - General collection.	500,000
	1976 - Trunk line to Gilroy.	1,000,000
	1976-80 - Collection lines and existing system replacement.	750,000*
Mountain View	None.	
Palo Alto	1971-72 - Mains and services.	32,100*
	1972-73 - Same as above.	24,600*
	1973-74 - Same as above.	45,000*
	1974-75 - Same as above.	46,000*
	1975-76 - Same as above.	16,500*

Table 23 (Continued)

Agency	Description of Project	Capital Cost Estimate
Santa Clara County		
Santa Clara	1970 - Extensions, repairs, trunk lines.	$ 446,000*
	1971 - Same as above.	531,000*
	1972 - Same as above.	196,000*
	1973 - Same as above.	277,000*
	1974 - Same as above.	283,000*
	1975 - Local improvements.	300,000*
	1976 - Same as above.	204,000*
	1977 - Same as above.	203,000*
	1978 - Same as above.	202,000*
	1979 - Same as above.	200,000*
	1980 - Same as above.	199,000*
Sunnyvale	1971-73 - Extensions and improvements.	13,000*
	1973-74 - Same as above.	28,000*
	1974-75 - Same as above.	15,000*
	1975-80 - Same as above.	25,000*
Sunol Sanitary District	None.	
San Jose	1970-80 - Expansion of collection system (approximately $1,000,000/yr).	10,000,000
	1970-80 - Remedial work or replacement of old facilities (approximately $150,000/yr).	1,500,000*

Table 23 (Continued)

Agency	Description of Project	Capital Cost Estimate
Solano County		
Benicia	None.	$
Dixon	1971 - Trunk sewer.	137,400
Fairfield	None.	
Fairfield - Suisun Sanitary District	NIR.	
Rio Vista	NIR.	
Vacaville	1975 - 18-inch main to northeast of town.	280,000
	1977 - Construct gravity main from Brown St. plant to Easterly plant.	700,000
Vallejo Sanitation and Flood Control District	1971 - Stormwater separation project.	1,000,000
	After 1973 - Remedial work or replacement of old facilities.	400,000/yr*
Sonoma County		
Cotati	1971 - Trunk sewers.	8,000
	1972-78 - Expansion of collection system.	110,000
Cloverdale	NIR.	
Healdsburg	1973-75 - Dry Creek interceptor.	400,000
	1975-80 - Fitch Mt. interceptor.	300,000
Petaluma	None.	

Table 23 (Continued)

Agency	Description of Project	Capital Cost Estimate
Sonoma County		
Rohnert Park	NIR.	$
Santa Rosa	1973 - Llano interceptor.	1,500,000
Sebastopol	NIR.	
Sonoma Valley County Sanitation District	1972 - West interceptor.	1,800,000
	1974 - Eighth St. East interceptor.	1,200,000

Chapter 6

DRAINAGE

Of the three major components of the total water resource--potable water, wastewater, and surface drainage--the one generally least considered in a regional or water quality aspect is drainage. The bay region estuarine system receives precipitation runoff from land areas where almost all of the region's population lives or works. Thus it is the regional recipient of a great deal of stormwater polluted by man's urban area land activity. Although siltation and transport of other erosion products have always presented problems, stormwater pollution from urban area land activity, until recently, has been somewhat passively tolerated if not completely unrecognized by the public. It is hopeful that public awareness is increasing and that support might be obtained for recognizing urban stormwater pollution for what it is--a regional water quality problem.

Background

The primary concern today is control of flooding and maintenance of drainage channel capacity. At the present time, responsibilities for flood control and drainage throughout the nine-county study area are divided variously among the following kinds of government entities:

1. County
2. County Flood Control and Water Conservation District
   County Flood Control and Water District
   County Flood Control District
   County Water Agency
3. City
4. U.S. Army Corps of Engineers
5. U.S. Department of Agriculture, Soil Conservation Service

There is no fixed pattern for the separation of responsibilities for these entities, and it is beyond the scope of this report to attempt to identify specifically each kind of relationship. It should suffice to say that these entities have studied all of the various drainage basins and the past or potential flood situations in adequate depth to ascertain general needs.

In some counties the county government, through its Department of Public Works or County Engineer's Department, performs flood control and drainage work. In other counties there are the aforesaid kinds of special purpose districts.

The variously named FCD's (flood control districts) are separate legal entities, authorized by the state legislature. In general, they provide for the control and conservation of flood and stormwaters, the protection of watercourses, watersheds, public highways and life and property from damage or destruction from such waters, the prevention of waste or the diminution of the water supply, and the development and importation of water for beneficial use within the FCD. In some counties they also exercise transport and wholesaling duties with regard to potable water. Some of them operate throughout the county; others operate only within certain zones of the county.

In addition to the counties and FCD's, nearly all of the more than 80 cities in the study area have responsibility for storm drainage within, and sometimes adjacent to, their city limits. They often participate in larger projects on a joint basis with the respective FCD's.

The Army Corps of Engineers has been engaged in water resources development in California for over a century. Its responsibilities are quite broad and are not particularly well-known to the general public. Included among its duties are planning and constructing flood control and multipurpose projects, prevention of beach erosion, fighting floods, and reporting engineering investigations of all major streams.

The Soil Conservation Service of the U.S. Department of Agriculture has responsibilities related to flood prevention and agricultural water management. These are discharged primarily through administration of the Public Law 566 program in which various proposed projects are evaluated on a cost-benefit basis and federally appropriated funds are assigned. The balance of the funding must be supplied by the benefiting local entity.

Nearly every one of these entities has some kind of a plan and some kind of a program. However, the only cooperative planning noted is in the few instances where a particular drainage basin happens to be in more than a single county or where the Army Corps of Engineers has a project and the local entity supplements with work beyond the jurisdiction of the Army Corps.

Planning Objectives and Guidelines

In the continuing effort to enhance the quality of life for man, provision for controlling stormwater runoff has required much effort and capital expenditure. By its very nature urban man's way of living has complicated the control of such runoff by creating a pollution factor. Thus storm drainage from urban areas, although a potential hazard and a potential resource, is actually a wastewater requiring treatment to prevent or minimize degradation of receiving waters.

In this context objectives and guidelines are listed below.

Objectives

1. Reduction of hazards to life of man and his animals.
2. Reduction of hazards to property.
3. Preservation of environmental quality.
4. Beneficial use of stormwaters where possible.

Guidelines

1. Recognition of the regional implications of discharge of stormwaters to the common receiving water--the San Francisco Bay estuarine system.
    a. Effect on adjoining entities.

    b. Potential for reclamation and supplanting use of potable water elsewhere in the region.
    c. Interrelationship with wastewater.
2. Alleviation of pollution effects.
3. Seasonal utilization of flood channels and holding areas.
4. Utilization of erosion products.

Short-Range Program

The various primary entities responsible for flood control were contacted during the study and a wide range of ongoing planning effort was encountered. In many cases, drainage studies have already been carried out and the solutions which are necessary to correct the problems have been determined. In other cases, only the problem was defined. Priorities in time had usually been assigned to specific proposed projects. Other projects were just deemed "desirable subject to availability of funds."

The Phase II Program for drainage, presented in Table 24 (page 190), consists of various short-range subregional projects with capital cost estimates, as reported by the various entities during the course of this study. The information was obtained from mailed questionnaires and several interviews with entity personnel. A discussion of the responsible agencies and the projects that are planned, by county, is presented in the remainder of this chapter.

Alameda County

The primary responsibility for flood control in Alameda County lies with the Alameda County Flood Control and Water Conservation District and the various cities in the county in cooperation with the FCD.

The FCD is empowered to form zones in the area where improvements are to be constructed. Such zones may encompass one or more cities. There are now 13 zones covering all of Alameda County, and each is a financial entity which may raise funds for the construction and maintenance of the facilities within its particular zone. Essentially all of the flood control and drainage work performed in the county is done under the auspices of the FCD. Storm drainage requirements for new developments are put in by the developers to specifications provided by the FCD.

Since its formation in 1949, the FCD has been responsible for extensive flood control construction throughout Alameda County, and it is embarked on a continuing program as availability of funds permits. FCD plans for the short-range period have been established. The estimated cost of the work is $30 million.

Albany. The City of Albany provides storm drainage for all of its incorporated area. It anticipates in the short-range program the replacement and rerouting of storm drain facilities in the southeast portion of the city and correction of some drainage deficiencies in other areas. Portions of the two main east-to-west creeks in the area--Cerrito and Codornices creeks-- are in need of creek bank slope protection work or construction of box culverts; however, no specific project or estimate has been established for this work.

Berkeley. The City of Berkeley provides storm drainage facilities for all of the land within its corporate limits. No specific projects have been presented for improvement or upgrading of its facilities other than a proposed program of a fixed annual expenditure per year; however, it is known that numerous cross-connections between storm drainage facilities and sanitary sewers exist. Separation of such facilities is desirable, and it is likely that, depending on available financing, the work may be undertaken within the short-range period.

Emeryville. The city of Emeryville is essentially completely developed and requires only a small amount of upgrading and replacement. Some potential new development along the bay shoreline can be readily drained to the bay, and the cost of the facilities would be borne by the developers.

Major channel improvement work on Temescal Creek is currently underway. The work is being performed under the direction of the FCD.

Livermore. The City of Livermore maintains storm drainage facilities for the area within its city limits and some adjacent areas. It has a short-range program of storm drain lines installation over the next 10 years.

Oakland. The city of Oakland storm drainage system services approximately 65 percent of its total service area and proposes, subject to availability of funding, a continuing short-range program of sewer separation, cross-culvert removal, and expansion of existing systems.

Piedmont. The City of Piedmont maintains storm drainage facilities for all of its incorporated area and has established priorities for a short-range program consisting of seven projects.

Other Alameda County Cities. Other county cities have reported no short-range program inasmuch as all local in-tract drainage is taken care of by the property owners as development occurs. Such drainage facilities are designed to meet the requirements of the FCD.

Contra Costa County

The Contra Costa County Flood Control and Water Conservation District is the entity responsible for flood control and drainage throughout most of the county which has extensive need for drainage improvements. The order-of-magnitude estimate of costs for these improvements is a quarter of a billion dollars. All of the cities in the county except Richmond and El Cerrito participate with the FCD in respective pertinent areas. The cities take care of their own internal drainage problems and the FCD administers contracts affecting the larger drainage basins. Richmond and El Cerrito maintain responsibility for their own flood control program and the FCD does not become involved.

Although the FCD has powers for development of water supply, they are not exercised. As in Alameda County, there are several zones in the

FCD, each one representing a watershed area; however, the zones do not cover the entire county.

The state legislature act which formed the FCD contained a relatively low tax limit which has made it difficult to perform as much flood control work as is needed. Nevertheless, to date the FCD has been responsible for the construction of four dams and 14 miles of channel improvement. In 1970 it administered contracts for the Walnut Creek channel improvement project which had a total cost of $4,800,000.

Antioch. The City of Antioch maintains storm drainage facilities for all of its incorporated area and has submitted a short-range program consisting of two projects in the vicinity of Antioch Creek.

Concord. The city of Concord has recently experienced flooding in some of its local drainage areas, which are a City responsibility rather than an FCD responsibility. Such improvements as replacing old, undersized facilities and adding new ones are needed. The primary difficulty has been in obtaining financing in the amounts necessary to perform the work.

El Cerrito. The city of El Cerrito does not lie within any of the watershed zones of the FCD. Within the city limits, the community has been working on several projects from an existing priority list. The work was started in 1970 and includes a combination of new and expanded facilities as well as replacement and upgrading work on the existing system. In 1970 El Cerrito completed major work on Cerrito Creek, a major outlet channel, and a drainage system in an adjacent area.

Lafayette. There are a large number of spring-fed natural creeks in the city; many of them flow all year. The stormwater drainage system consists of short lengths of drain pipe which convey the flow from these creeks and stormwater from small drainage areas into nearby larger creeks. As a result, severe problems of creek erosion have developed. The storm drainage system itself has only minor problems.

Richmond. The City of Richmond currently has in the design phase an approved HUD project in the civic center district, and construction is expected to be completed in 1972. At present the FCD is attempting to obtain HUD aid for a project in unincorporated North Richmond. The drainage work would be part of the HUD Model Cities program in the area.

San Pablo. The City of San Pablo maintains storm drainage facilities for all of its incorporated area and has plans for two short-range projects.

Walnut Creek. The City of Walnut Creek presently maintains storm drainage facilities for about one-half of its service area. Projects on Walnut Creek and San Ramon Creek, financed by the Corps of Engineers and administered by the FCD, were reported for the 1970-71 period.

Marin County

The Marin County Flood Control and Water Conservation District has jurisdiction for flood control and drainage for the county. At present it has formed eight zones for improvement purposes; the zones do not encompass all of the county. Several small projects are in the planning stage but no overall plan exists at present. In the opinion of the staff members this lack is the primary deficiency. In lieu of locally sponsored and financed projects the Army Corps of Engineers has initiated several flood control projects in the county. One of these is the Corte Madera project in Ross Valley, which is presently under construction. Other projects will be on Novato Creek and on the Arroyo Corte Madera del Presidio. It is not anticipated that any HUD funds will be required other than possible funds for preserving aesthetics.

Belvedere. The City of Belvedere plans to divert stormwater from Belvedere Lagoon to Richardson Bay or Belvedere Cove to eliminate silting if and when funds are available. It has recently approved a contribution of funds to the City of Tiburon for use in a proposed project to divert stormwater runoff from the Tiburon watershed to Raccoon Straits to alleviate flooding in Belvedere.

Larkspur. The City of Larkspur maintains storm drainage facilities for all of its incorporated area and has short-range plans to upgrade them in specific areas.

Novato. The city of Novato is located in the Novato Creek watershed and several smaller watersheds generally comprising the northeast portion of Marin County. As previously stated, the Army Corps of Engineers plans a flood control project on Novato Creek. The immediate need is for improvement on Rush Creek headwaters inasmuch as the downtown area is presently exposed to local flooding. The northwest area of the city is also presently exposed to local flooding, and improvements are badly needed.

Ross. The City of Ross maintains storm drainage facilities for all of its incorporated area and has short-range plans for upgrading and needed new works.

San Anselmo. The city of San Anselmo storm drain system was installed 40 to 50 years ago and consists essentially of corrugated metal pipe. The system has begun to fail and is inadequate for current development. Much of the system is located on private property. A complete master plan for storm drainage is badly needed.

San Rafael. The city of San Rafael is located centrally in the watershed basins of San Rafael Creek and Los Gallinas Creek. In general, the San Rafael basin does not have adequate drainage facilities. A tentative 10-year program of remedying existing deficiencies has been developed. The program consists of six projects. No specific plans at this time for funding the program have been made.

Sausalito. The City of Sausalito maintains storm drainage facilities within all of its incorporated area and plans only minor expansions in the short-range.

Napa County

The Napa County Flood Control and Water Conservation District is responsible for flood control and storm drainage for all of Napa County, excluding urban storm drain facilities in incorporated cities. The Army Corps of Engineers and the Soil Conservation Service also have projects in the county.

The FCD initiates projects within the general county area as needs arise and as funds are available. No long-range plan or program has been developed. The FCD plans to initiate some projects upon completion of a planned Army Corps of Engineers Napa River project; however, the FCD projects are not now in the planning stage. The FCD is presently cooperating with the incorporated cities in Napa County on a cost-sharing program for storm drainage projects within the various cities; however, there still remain numerous deficiencies.

The Napa River project, authorized by the 1965 Flood Control Act, provides for channel enlargement and realignment, construction of levees, floodwalls, and public boat launching facilities in an 11-mile reach downstream from Trancas Road in the city of Napa. This project has been under study by the Army Corps of Engineers, and at present detailed planning is completed and under review.

The Soil Conservation Service is contemplating construction of a dam on Redwood Creek, a tributary to the Napa River. There would also be channel work on the Napa River northerly from Trancas Street. The Soil Conservation Service also has some long-range plans for other improvements in Napa Valley.

Napa. Most of the downtown and older areas of the city of Napa originally were served by combined sewers. Some years ago a major separation program was completed by construction of new sanitary sewers. However, the remaining combined sewers, now used only for storm drains, are still inadequate by present-day standards. Subsequent progress on storm drainage improvements within these areas has been very slow due to lack of funds. Some improvements are being made as part of the current HUD urban renewal program.

Other Napa County Cities. The other cities in the county operate in essentially the same fasion as Napa with respect to the FCD. They take care of their own internal drainage problems and the FCD administers contracts affecting the larger drainage basins.

City and County of San Francisco

The City and County of San Francisco is the only entity within the Bay Area that has a true combined sewer system in which all drainage and domestic wastes are carried in the same pipes. This system has been discussed in the sewerage portion of this report.

San Mateo County

In San Mateo County, the San Mateo County Flood Control District has primary areawide storm drainage powers although it functions somewhat differently from others in the region. Its powers are essentially similar to those of other FCD's; however, the Board of Directors--which is also the County Board of Supervisors--has chosen to utilize the FCD powers and to form zones only where there is a specific demand and need for them. To date, only four watershed areas have been designated as zones--Colma Creek, San Bruno Creek, San Francisquito Creek, and Ravenswood Slough. Some cities occupy essentially an entire watershed and have utilized city powers to provide their own flood control and drainage protection; thus, there has been no need for the County to participate.

In the Colma Creek zone the County has requested that the Corps of Engineers consider enlarging and improving the creek throughout the whole length of its run through South San Francisco. To date only a limited amount of channel work has been done in a portion of Twelve Mile Creek and the Spruce Creek Branch.

In the San Bruno Creek zone a project has recently been completed which provided major flood protection for the watershed; however, there are still instances of local flooding problems.

In the San Francisquito Creek zone the watershed lies astride of the San Mateo-Santa Clara county line. The counties have a joint project underway which is intended to correct immediate deficiencies along the creek. For some years the Corps of Engineers has studied this watershed and has recently determined, in the light of the new construction work, that no project is feasible within the framework of the federal cost-benefit ratio criteria.

In the Ravenswood Slough zone, there is a proposed project which would serve essentially the entire watershed. This project would correct numerous deficiencies and is currently being discussed with HUD.

In the Pescadero Creek watershed, the Corps of Engineers has completed studies leading toward flood control structures and water supply development. It is presently intended, subject to availability of funding, that two separate reservoirs will be constructed. The first one is the Worley Flats Reservoir, which will be mainly for flood control and will be sufficient until about 1980, at which time the second one, Portola Reservoir, will be constructed mainly for water supply.

Atherton. The Town of Atherton maintains storm drainage facilities, in conjunction with the Atherton Channel Drainage District, for all of its incorporated area and adjacent unincorporated areas. The Drainage District also includes some of Menlo Park; however, maintenance of those facilities is performed by that City. Atherton and the Drainage District have developed a short-range program consisting of seven projects. There are long-range plans for drainage improvements in the north part of Atherton, generally known as the Selby Road area, and for a storage basin near San Francisco Bay adjacent to Marsh Road.

Brisbane. The City of Brisbane maintains storm drainage facilities for all of its incorporated area. The facilities are considered inadequate and immediate improvements are needed; therefore, the City short-range program consists essentially of taking care of its deficiencies.

Burlingame. The City of Burlingame maintains storm drainage facilities for all of its incorporated area. Its facilities also receive flow from San Mateo, Hillsborough, Millbrae, and unincorporated county areas. Several minor drainage improvements are needed, but there is no major deficiency in that part of the system under City responsibility. A bond issue was passed prior to 1960 which provided funds for construction of all the major improvements needed in Burlingame, other than subdivision improvements made by developers as part of their requirements.

Daly City. The City of Daly City maintains storm drainage facilities for all of its incorporated area and has a short-range program consisting of two projects. The only long-range plans within Daly City would arise from development of the Crocker lands on San Bruno Mountain and it is most likely that the developer would pay all costs.

Millbrae. The City of Millbrae maintains storm drainage facilities for all of its incorporated area and has developed a short-range program consisting of five projects. Its long-range plans consist of additional storm drainage facilities on El Camino Real and the enclosure of both the high-line and the low-line Lomita canals.

Pacifica. The City of Pacifica maintains storm drainage facilities for all of its incorporated area and has developed a short-range program consisting of eight projects.

Portola Valley. The Town of Portola Valley maintains basic storm drainage facilities for approximately 60 percent of its incorporated area. It has a master drainage plan which is under review at the present time. No schedule has been adopted; however, there are deficiencies which will likely constitute the Town short-range program. The elimination of these deficiencies should obviate the need for specific long-range plans. All additional drainage facilities would be provided by developers.

San Francisco International Airport. The airport drainage system has operated through several large storms in recent years without flooding. The system is losing capacity due to settlement of pipe along with the airport fill. Pipes crossing former dikes have not settled as fast. Paving of formerly unused areas has increased surface runoff. The existing 45-inch drain which carries stormwater from the canal near the North Oxidation Pond to Drainage Pumping Station No. 2 has insufficient capacity to serve the entire area now draining to it.

A television survey should be made of the primary drains and repairs made as needed. Relief drains are needed where former dikes restrict flow. A new intercepting drain is needed for runways and taxiways south of the terminal. A new pump station is needed to prevent flooding of the area west of Airport Boulevard. Tide gates should be repaired or replaced to prevent backup into the drainage system.

A general master plan has been prepared and funding for much of the needed facilities is anticipated as part of a general airport expansion program which is underway.

San Mateo. The City of San Mateo maintains storm drainage facilities for all of its incorporated area and plans an on-going program of expansion of the existing system. Its short-range program consists of four projects. Its long-range plans include further expansion of the existing system and replacement of older facilities.

South San Francisco. The City of South San Francisco maintains storm drainage facilities for all of its incorporated area and has developed a short-range program consisting of seven projects. In addition, a most urgent need, as has been mentioned, is the enlargement and improvement of the Colma Creek drainage channel through the full length of the city.

Other San Mateo County Cities. Other San Mateo County cities--Colma, Half Moon Bay, Hillsborough, and Woodside--have no major storm drainage deficiencies and anticipate only such drainage facility construction as may be done by future land developers.

Other San Mateo County Areas. Adjacent to Redwood City there are several unincorporated areas which need additional storm drainage facilities. They are the Emerald Lake, Sequoia Tract, and North Fairoaks areas. The North Fairoaks area is particularly deficient in adequate facilities.

In the East Palo Alto unincorporated area there is presently underway a Belle Haven storm drain project consisting of the aforesaid Ravenswood Slough project and one to the east of it within the watershed of San Francisquito Creek.

On the ocean side of the county, the two cities, Half Moon Bay and Pacifica, have developed drainage programs which are being implemented as availability of funds permits. The unincorporated community of El Granada has extensive drainage deficiencies; however, the local citizens have evinced no interest in financing improvements.

A plan for the Denniston Creek watershed area north of El Granada has been developed and deficiencies have been identified. No implementation of the plan is actively under consideration at this time.

The upper reaches of San Bruno Mountain are undeveloped and it contributes runoff to several watersheds, one of which is the aforesaid Colma Creek. Two other watersheds--Brisbane Creek and Guadalupe Creek--have not yet had any major long-range planning performed for them.

Santa Clara County

Responsibility for flood control, improvements in natural drainage channels, and storm drainage structures is spread among three types of entities in Santa Clara County--the Santa Clara County Flood Control and Water District, the County of Santa Clara, and the various incorporated cities. The FCD maintains jurisdiction only over natural rivers and creeks, and some structures appurtenant thereto which are flood control improvements. The County Department of Public Works maintains jurisdiction over storm drainage facilities which are constructed in unincorporated areas, and the various cities do likewise within their corporate limits.

There are five flood control districts in Santa Clara County. Their activities are similar to those in most of the other counties. Each zone functions as a separate financial entity and funds its own improvements. The FCD has a program of developing continuing 5-year schedules of improvements and corrections of deficiencies. Thus, when a developer proposes work in a particular area, the required improvements in addition to in-tract developments are known, and the contractor may be obliged to construct some of the facilities in the program prior to their scheduled construction date. He is then reimbursed by the FCD at such time as that scheduled work would have been performed within the program.

FCD personnel cite the need for an extensive program of creek improvement, primarily in the central and northern portion of the county. Order-of-magnitude estimates of the cost of this work are presented in the table which follows.

Location	Amount
Guadalupe Creek (Hedding Street north)	$20,000,000
Coyote Creek	26,000,000
Coyote Creek (East Side tributaries)	25,000,000
Los Gatos Creek	10,000,000
Saratoga-San Tomas-Calabazas creeks	15,000,000
Stevens, Matadero, Adobe, Permanente, and Los Trancos creeks	10,000,000

San Francisquito Creek constitutes a portion of the northerly boundary of the county. Proposed work on it has been discussed under the San Mateo County heading.

The County of Santa Clara developed a master storm drainage plan in 1965 and uses it as a primary guide for all unincorporated areas. The incorporated cities generally also utilize the master storm drainage plan; however, as separate entities, they administer and direct the construction of the facilities.

The County has a specific short-range program consisting of three projects which, subject to availability of funds, would be constructed within the next 10 years. It is the opinion of County engineering personnel that after the completion of South County Freeway and Santa Teresa Expressway (South of Baily Avenue) the potential for rapid development is great and will probably start prior to 1980. Practically all of the drainage construction in this area as it develops would be the obligation of the developers. After 1980 it is anticipated that drainage construction would be in the general area easterly of Bayshore Freeway, in the Los Gatos area, and in the town of Los Altos Hills.

Gilroy. The City of Gilroy maintains storm drainage facilities for all of its incorporated area and has developed a short-range program consisting of six projects.

By far the most important project concerning the Gilroy area and southern Santa Clara County is that of channel improvements on Llagas Creek. This is a proposed Soil Conservation Service project which has been approved by Congress but as yet not funded. The order-of-magnitude estimate of cost is $4,000,000.

The city is in need of construction of several major drainage outfalls and reconstruction of storm drainage facilities in its older areas. It is likely that funding for this work will not be available within the next 10 years. In addition, there is need for channel control on the Uvas Creek. Similarly, funding is not anticipated within the next 10 years.

Los Altos Hills. The Town of Los Altos Hills maintains storm drainage facilities for all of its corporate area. In keeping with City policy of maintaining the area in as natural a state as possible, the extent of these facilities is minimal. Existing channels are used in their natural state as much as possible. However, the City does have a specific program of four projects within the next 10 years, three of which are intended to correct deficiencies.

Los Gatos. The City of Los Gatos maintains storm drainage facilities for all of its incorporated area and has developed a short-range program consisting of nine projects.

Mountain View. The City of Mountain View maintains storm drainage facilities for approximately 80 percent of its total service area and anticipates improvements in the 800-acre area north of Bayshore Freeway within the next 10 years. Costs would be shared by developers and no specific details of a development plan have yet been determined. In the present City service area numerous collection system improvements are needed, and an order-of-magnitude estimate of cost is $1,500,000; however, specific requirements have not been determined either.

Palo Alto. The City of Palo Alto maintains storm drainage facilities for most of its incorporated area. It is in general following a 1965 consultant's report which set forth projects for a short-range program over the next several years. In the long-range, Palo Alto is planning a continuation of updating the existing storm drainage facilities throughout the city.

San Jose. The City of San Jose maintains storm drainage facilities for all of its developed area, which is approximately 50 percent of its present corporate limits and 25 percent of what is considered to be its ultimate corporate area. Within the next 10 years it is anticipated that expansion of storm drainage systems and addition of new storm drainage facilities will require funding of approximately $1,200,000 per year. In addition, remedial work or replacement of older facilities will require approximately $150,000 per year. Subsequent to 1980 it is anticipated that there will be continuing expansion of storm drainage facilities, together with additional remedial work and replacement of old facilities.

Santa Clara. The City of Santa Clara maintains storm drainage facilities for approximately 85 percent of its total service area and has developed a short-range program consisting of five projects within the next 10 years. City personnel have no specific long-range program for subsequent years.

Sunnyvale. The City of Sunnyvale maintains storm drainage facilities for approximately 90 percent of its total service area. During the 1950-60 decade the City developed a master plan for its storm drain system, and during the intervening years the system has been developed almost according to the original master plan. There are now approximately 115 miles of storm drain, varying in size from 12 to 48 inches in diameter, and the system is relatively complete. Further additions will be at the expense of subdividers; therefore, relatively little will be constructed within the next 10 years by the City. It is anticipated that a new pump station and upgrading of certain of the residential areas is all that will be required.

With regard to long-range plans, City personnel are of the opinion that only minor replacement of mechanical items will be required. The storm drain system was designed to handle saturation development, and therefore it is felt that little reconstruction will be necessary in the next 30 years.

Land in the northern portion of the city has been subsiding at a substantial rate, up to 0.3 feet per year, and during the past 20 years certain portions have subsided to an elevation below high tide level. Such subsidence dictated that pumping facilities had to be constructed to drain such areas. The FCD maintains the levees around the areas and the City is responsible for pumping stormwaters to the bay. Future subsidence conditions will dictate the extent of pumping facilities required.

Other Santa Clara County Cities. The other cities in Santa Clara County have substantially no additional storm drainage requirements and anticipate that the only improvements which will be made will be by developers and at their expense.

Solano County

As has been mentioned, the County of Solano is not a member of ABAG and has not submitted an inventory of existing and proposed facilities; however, four cities within the county have submitted such information.

Benicia. The City of Benicia provides storm drainage facilities for approximately 80 percent of its incorporated area. Its location adjacent to Suisun Bay makes it unnecessary to relate with any other flood control or storm drainage entity. City personnel have indicated that in the future some low area drain pipe may require replacing or relocating because of tidal actions as far back from the waterfront as 3,000 feet.

Dixon. The City of Dixon provides storm drainage for all of its incorporated area and has no major deficiencies at this time. However, its short-range program does include a Dixon Creek storm drainage project.

Suisun City. Suisun City provides storm drainage for all of its incorporated area and does not have any major deficiencies. It has two projects in its short-range program.

Vacaville. The City of Vacaville provides storm drainage for approximately 90 percent of its incorporated area. It has not designated any major deficiencies; however, it has three projects proposed for the short range. It also has a long-range plan for an estimated $3 million project to improve Alamo Creek within the next 10 to 12 years. Another project is to clear and riprap sections of Ulatis Creek. The cost of this work is undetermined.

Sonoma County

The Sonoma County Water Agency is the entity responsible for flood control and drainage throughout Sonoma County. The various cities in the county have contracted with the Water Agency for review of developers' storm drain plans to assure compatibility with the overall flood control and drainage plan. The extent of city activity in storm drainage, in Sonoma County, is generally to accept underground facilities within their respective city limits for maintenance and to participate financially in construction which affects them.

Need for Long-Range Drainage Plans

Long-range plans for drainage (as differentiated from combined sewer waste flow) in the bay region are basically subregional by major watershed and county. Where a watershed occupies two counties there would continue to be a joint venture approach. The planning noted seems to consist primarily of recognizing and anticipating needs, determining order-of-magnitude costs, and setting tentative priorities. There is a need for including drainage planning within the framework of management of the total water resource. As continuing effort is applied to improving water quality throughout the Bay Area estuarine system by requiring a high degree of treatment of wastewaters, so should similar effort be applied to the maintenance of high standards of water quality in storm runoff.

There is general public support for the Regional Water Quality Control Board effort in establishing water quality objectives and striving to see that they are achieved. A time should come when similar public support arises and similar effort can be applied on a regional basis to control stormwater pollution.

The matter of water quality control of stormwater runoff has been implemented only to the extent of deleting use of certain pesticides on both urban and agricultural lands. The achievement of even present water quality goals might in the long range require further pesticide, herbicide, and fertilizer restrictions and stormwater flow treatment.

Most people know that stormwater is not clean, pure rainwater, but that it picks up pollution on its route over the ground and through pipelines to a stream. However, it may be news, even to members of the engineering profession, that stormwater from urban areas is so highly contaminated that, for short periods, it often discharges more pollution than the primary effluent of a wastewater treatment plant. Treatment of stormwater flows--at least of the "first flush"--must be considered not only desirable, but necessary, although the many other problems of water resource management and water quality control render it far down the list of priorities. Nevertheless, stormwater is polluted by BOD, suspended solids, and coliform bacteria, and some treatment of it should be considered in any pollution control program involving secondary or higher degrees of treatment for sanitary sewage. If the stormwater reacts to treatment as does sanitary sewage, it may require chlorination, settling, chemical precipitation, or even biological treatment to reduce its pollution to a level in the range of treated sanitary sewage. It is difficult to foresee at this time whether treatment of all stormwater flow would ever be economically feasible, or even deemed desirable in much of the bay region. But the temporary retention and subsequent treatment of the aforesaid first flush would preclude a reasonably large fraction of stormwater pollution from entering the receiving waters.

Imaginative thinking is needed. For instance, the concept of upstream storage and reclamation of storm drain flows and utilization of the reclaimed waters in a major water-oriented recreational facility--albeit we have the bay--could be further explored.

Storage is an essential element of any such plan and imaginative thinking has resulted in more than simply damming up reservoir sites. For instance, the tunnel storage concept could be investigated further. It has the decided advantage of providing surcharge relief and has been considered by such entities as the City and County of San Francisco, the City of Chicago, and Washington, D.C.

Siltation in drainage channels is of continuing concern and those who look into the future beyond 10 years anticipate a very real problem in disposal of the silt in order to maintain channel flow capacity. Regional long-range planning in this field is needed. The products of upstream erosion must be placed somewhere and a regional approach might provide a solution, such as barge and/or truck transport to distant entities for use in sanitary landfill. The only other apparent solution is to find new ways to minimize erosion in the first place. The "more development means more erosion" syndrome should be attacked. Man's technological capabilities should be applied to development of suitable soil stabilization additives and methods to obviate the need for massive and extensive silt control structures.

In summation, there is a need for drainage to be brought into the total water resource management effort in fact and implementation, as well as in concept. Storm runoff can be a nuisance, a hazard, and a potential resource and should be considered from the regional viewpoint.

Table 24

SHORT-RANGE DRAINAGE PROJECTS

Agency	Description of Project	Capital Cost Estimate
Alameda County		
Alameda County FCD	Zone No. 2	
	1971 - Upper watershed projects.	$ 150,000
	1971 - Castro Valley - expansion of capacity.	300,000
	1971 - Drainage improvements, from Line N to Channel St.	300,000
	1971 - Drainage improvements, Pine St. to Catalina Dr.	200,000
	1971 - Drainage improvements (participation with Zone No. 2A).	25,000
	1971 - Drainage improvements, from Catalina Dr. to Berdina.	250,000
	1971 - Drainage improvements (San Lorenzo Creek) Foothill to prop. Freeway (R/W).	90,000
	1971 - Drainage improvements, from WPRR to Kent Ave.	85,000
	1971 - Drainage improvements in Washington Ave.	35,000
	1971 - Drainage improvements in Sycamore St.	35,000
	1972 - Drainage improvements, Lake Chabot Road to Carlton.	15,000
	1972 - Drainage improvements, vic. Hannah Dr.	30,000
	1972 - Drainage improvements, above Berdina to upper limit (bank protection).	300,000
	1972 - Upper watershed projects.	230,000
	1973 - San Lorenzo Creek (bank protection), above Foothill.	300,000
	1973 - Upper watershed projects.	300,000

Table 24 (Continued)

Agency	Description of Project	Capital Cost Estimate
Alameda County		
	Zone No. 2A.	
	1971 - Drainage improvements, Halsey Ave. to above Lark St.	$ 50,600
	1972 - Drainage improvements, concrete lining, Phase I.	38,000
	1973 - Drainage improvements, concrete lining, Phase II.	39,000
	Zone No. 3A.	
	1971 - Pumping Plant "G," Alvarado.	160,000
	1971 - Drainage improvements.	60,000
	1972 - Drainage improvements, Tennyson Road to Jefferson St.	95,000
	1972 - Drainage improvements in Whipple Road.	150,000
	1973 - Drainage improvements, Jackson St. upstream.	65,000
	1973 - Drainage improvements, Union City.	60,000
	Zone No. 4.	
	1971 - Drainage improvements, vic. Middle Lane and Eden Ave.	30,000
	1971 - Drainage improvements, complete upper reach in Winton Ave.	60,000
	1971 - Drainage improvements, Clawiter Road upstream.	80,000
	1971 - Drainage improvements.	40,000
	1971 - Drainage improvements, Phase II.	60,000
	1972 - Drainage improvements.	150,000
	1973 - Same as above.	150,000

Table 24 (Continued)

Agency	Description of Project	Capital Cost Estimate
Alameda County		
	Zone No. 5.	
	1971 - Drainage improvements, from Line C to Fremont Blvd.	$ 32,000
	1971 - Drainage improvements, Cherry Lane to WPRR.	160,000
	1971 - Drainage improvements, vic. Colgate Dr. to 13th St.	40,000
	1971 - Drainage improvements (agreement with Newark).	37,000
	1971 - Drainage improvements, Newark Blvd. to Nimitz Freeway.	200,000
	1971 - Drainage improvements, Newark.	60,000
	1971 - Drainage improvements, Fremont.	100,000
	1971 - Drainage improvements, partial concrete lining.	200,000
	1972 - Drainage improvements.	300,000
	1972 - Drainage improvements, Fremont Blvd. crossings.	50,000
	1973 - Drainage improvements, from Fremont Blvd. upstream.	80,000
	1973 - Drainage improvements, Lining - Phase II.	200,000
	Zone No. 6.	
	1971 - Drainage improvements, WPRR to Osgood Road.	95,000
	1971 - Drainage improvements, above Nimitz Freeway to Warm Springs Blvd.	120,000
	1971 - Drainage improvements, SPRR to Boyce Road.	80,000

Table 24 (Continued)

Agency	Description of Project	Capital Cost Estimate
Alameda County		
	1973 - Drainage improvements (Arroyo de la Laguna), downstream from Bernal Ave. (partial channel improvements).	$ 175,000
	Zone No. 9.	
	1971 - Drainage improvements, SPRR to junction with Line C.	152,000
	Zone No. 12.	
	1971 - Drainage improvements (Sausal Creek) vic. McKillop Slide.	1,000,000
	1971 - Drainage improvements (Courtland Creek) 50th Ave. to Foothill Blvd.	1,000,000
	1971 - Drainage improvements (Temescal Creek) vic. Telegraph to Hardy.	700,000
	1971 - Drainage improvements (San Leandro Creek) federal project R/W.	250,000
	1971 - Drainage improvements (Arroyo Viejo) vic. Hawley to East 14th (agreement with Oakland).	450,000
	1972 - Drainage improvements (Peralta Creek) Phase I - Nimitz Freeway U.S.	300,000
	1972 - Drainage improvements (Seminary Creek) Nimitz Freeway to East 14th.	1,000,000
	1972 - Drainage improvements (Temescal Creek) San Pablo to Adeline (Phase I).	400,000
	1973 - Drainage improvements (Peralta Creek) Phase II - to Foothill.	800,000

Table 24 (Continued)

Agency	Description of Project	Capital Cost Estimate
Alameda County		
	1971 - Drainage improvements, Mission Creek to WPRR.	$ 70,000
	1971 - Drainage improvements, Lagoon to Morrison Canyon Road.	200,000
	1971 - Boyce Road crossing.	15,000
	1972 - Drainage improvements, concrete lining, Phase I.	100,000
	1973 - Upper watershed projects.	110,000
	Zone No. 7.	
	1971 - Drainage improvements (Arroyo Mocho), Pleasanton Canal to Santa Rita Road.	140,000
	1971 - Drainage improvements (Arroyo Mocho), Santa Rita Bridge.	150,000
	1971 - Drainage improvements (Arroyo Mocho), SPRR crossing.	50,000
	1971 - Drainage improvements (Tassajara), SPRR crossing.	35,000
	1971 - Drainage improvements (Tassajara), Line G to Highway 580.	240,000
	1971 - Drainage improvements (Arroyo Seco), 30-inch gas line relocation.	25,000
	1972 - Drainage improvements (Arroyo Mocho), Line B to Hopyard Road (silt removal).	25,000
	1972 - Drainage improvements (Arroyo Mocho), Line G-3 to El Charro Road.	340,000
	1972 - Drainage improvements (Arroyo de la Laguna), Bernal Ave. to Hacienda Road, R/W only.	250,000

Table 24 (Continued)

Agency	Description of Project	Capital Cost Estimate
Alameda County		
	1973 - Drainage improvements (Temescal Creek) San Pablo to Adeline - Phase II.	$ 400,000
	1973 - Drainage improvements (Temescal Creek) Adeline to Grove.	500,000
	Zone No. 13.	
	1971 - Drainage improvements (San Leandro Creek, federal project R/W).	500,000
	1971 - Drainage improvements, Nimitz Freeway, upstream.	179,000
Alameda	None.(1)	
Albany	1972 - Replacement and rerouting storm drain system in southeast portion of city.	90,000
	1974 - Correct drainage facilities in other areas of city.	20,000
Berkeley	1970-79 - Replace old sewer lines.	345,000/yr
Emeryville	Upgrading and replacement.	< 50,000
Fremont	Included in FCD.	
Hayward	None.	
Livermore	1970-71 - Storm drain lines installation.	228,000
	1971-72 - Same as above.	200,000
	1972-73 - Same as above.	149,000
	1973-74 - Same as above.	82,000
	1974-75 - Same as above.	180,000

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(1) Information received--no projects.

Table 24 (Continued)

Agency	Description of Project	Capital Cost Estimate
Alameda County		
	1975-76 - Storm drain lines installation.	$ 96,000
	1976-80 - Same as above.	500,000
Newark	Included in FCD.	
Oakland	1971-79 - Sewage separation, cross-culvert removal, expansion of existing systems.	300,000/yr
Piedmont	1970-71 - Blair storm system.	40,000*
	1972-73 - Park Lane and Oak Road.	15,000*
	1973-74 - Lakeview and Poplar Way system.	25,000*
	1975-76 - San Carlos and El Cerrito system.	40,000
	1976-77 - Winsor Ave. and Harvard Road.	15,000
	1978-79 - Somerset, Huntleigh, and Lexford.	40,000
	1979-81 - Open creek channels.	40,000
Pleasanton	Included in FCD.	
San Leandro	None.	
Union City	NIR.(2)	
Contra Costa County		
Contra Costa County FCD	Marsh Creek Watershed Area	
	Brentwood area - Proposed storm drainage system of closed conduit and open channels.	2,000,000

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(2) No information received.

* Remedial project.

Table 24 (Continued)

Agency	Description of Project	Capital Cost Estimate
Contra Costa County		
	Knightsen area - Proposed storm drainage system of closed conduit and open channels. Includes pump plants.	$ 5,000,000
	Oakley area - Proposed closed conduit storm drainage system.	3,000,000
	Kellogg Creek Watershed Area	
	Kellogg Creek channel improvement - Increase creek waterway area by constructing an adequate earth channel. Also construct dam.	2,000,000
	Walnut Creek Watershed Area	
	Pine and Galindo Creek channel improvements - Increase creek waterway area by constructing an adequate concrete-lined channel and dams.	10,000,000
	Las Trampas Creek channel improvements - Increase creek waterway area by constructing an adequate earth channel and drop structures.	8,000,000
	San Ramon Creek channel improvements - Same as above.	9,500,000
	Green Valley Creek channel improvements - Same as above.	1,500,000
	Sycamore Creek channel improvements - Same as above.	900,000
	Clayton Valley side drain channel improvements - Same as above.	1,000,000
	Martinez area - Proposed storm drainage system of open channels.	3,500,000
	Concord area - Proposed storm drainage system of open channels and closed conduits.	12,500,000

Table 24 (Continued)

Agency	Description of Project	Capital Cost Estimate
Contra Costa County		
	Pacheco area - Proposed storm drainage system of open channels and closed conduits.	$ 1,400,000
	Pleasant Hill area - Same as above.	10,150,000
	Walnut Creek area - Same as above.	17,000,000
	Alamo area - Same as above.	5,800,000
	Danville area - Same as above.	11,000,000
	Lafayette area - Same as above.	8,900,000
	Diablo Creek Watershed Area	
	Diablo Creek channel improvements - Increase creek waterway area by constructing an adequate earth channel and drop structures.	8,000,000
	Mitchell Creek channel improvements - Same as above.	1,000,000
	Clyde area - Proposed drainage system of closed conduits and open channels.	250,000
	Concord area - Same as above.	2,500,000
	Clayton area - Same as above.	20,500,000
	Alhambra Creek Watershed Area	
	Alhambra Creek channel improvements - Reducing flooding and inundation by bypassing a portion of the creek with closed conduit storm drains.	9,000,000
	Martinez area - Proposed drainage system of closed conduits and open channels.	12,100,000

Table 24 (Continued)

Agency	Description of Project	Capital Cost Estimate
Contra Costa County		
	San Pablo Creek Watershed Area	
	San Pablo Creek channel improvements - Increase waterway area by constructing an adequate earth channel.	$ 4,000,000
	Richmond area - Proposed drainage system of closed conduits and open channels.	4,000,000
	Wildcat Creek Watershed Area	
	Wildcat Creek channel improvements - Increase waterway area by constructing an adequate earth channel.	8,000,000
	Richmond area - Proposed drainage system of closed conduits, open channel and pumps.	2,000,000
	Rodeo Creek Watershed Area	
	Rodeo area - Proposed system of closed conduits and open channels.	250,000
	West Antioch Creek Watershed Area	
	West Antioch Creek channel improvements - Increase waterway area by constructing an adequate earth channel.	3,100,000
	Antioch area - Proposed drainage system of closed conduits and open channels.	8,000,000
	Kirker Creek Watershed Area	
	Kirker Creek channel improvements - Increase waterway area by constructing an adequate earth channel.	8,000,000
	Pittsburg area - Proposed drainage system of closed conduits and open channels.	6,000,000

Table 24 (Continued)

Agency	Description of Project	Capital Cost Estimate
Contra Costa County		
	Miscellaneous Drainage Areas	
	El Cerrito - Richmond area - Increase waterway area of Cerrito Creek.	$ 500,000
	Crockett - Port Costa area - Proposed drainage system of closed conduits and open channels.	4,100,000
	Martinez area - Same as above.	1,000,000
	Shore Acres (Pittsburg area) - Same as above.	1,000,000
	Oakley area - Same as above.	8,000,000
	Delta islands - Proposed drainage system of closed conduits, open channels, and pumps.	3,000,000
	East Antioch Creek Watershed Area	
	East Antioch Creek channel improvements - Increase creek waterway area by constructing an adequate earth channel.	3,000,000
	Antioch area - Proposed drainage system of closed conduits and open channels.	1,000,000
Antioch	1975 - West Antioch Creek (County Service Area D-3).	3,600,000
	1975 - Connect 2 branches of East Antioch Creek at SPRR.	300,000*
Brentwood	NIR.	
Clayton	None.	
Concord	1972 - Local drainage area improvements, replacements, and additions.	5,300,000

Table 24 (Continued)

Agency	Description of Project	Capital Cost Estimate
Contra Costa County		
El Cerrito	1971-74 - Storm drainage facilities.	$ 45,000/yr
Hercules	None.	
Lafayette	1973 - Improving transverse and longitudinal drainage on Mt. Diablo Blvd.	100,000*
Martinez	NIR.	
Pinole	Included in FCD.	
Pittsburg	NIR.	
Pleasant Hill	None.	
Richmond	1970-74 - Civic center district (Storm Drain Area No. 6); Model Cities area (Storm Drain Area Nos. 1, 2, 3, and 5). HUD grant.	3,300,000*
	1972-73 - North Richmond area, HUD grant.	116,000*
	1974-75 - Richmond annex area, HUD grant.	1,000,000
	1975-76 - North central Richmond.	325,000
	1976-77 - South central Richmond.	325,000
	1977-78 - Richmond annex area.	325,000
	1978-79 - Miscellaneous remaining drainage facilities.	325,000
	1979-80 - Same as above.	325,000
San Pablo	1971 - ± 2,500-ft drain on Rumrill Blvd. 20th St. to Road 20.	75,000
	1975 - ± 3,000-ft drain, 17th St. from California St. to Wildcat Creek.	120,000

Table 24 (Continued)

Agency	Description of Project	Capital Cost Estimate
Contra Costa County		
Walnut Creek	1970 - Walnut Creek Channel I.	$ 1,500,000
	1970 - Walnut Creek Channel II.	1,800,000
	1970 - Walnut Creek Channel III.	1,500,000
	1971 - San Ramon Creek I.	900,000
	1971 - San Ramon Creek II.	1,800,000
Marin County		
Marin County FCD	1970-80 - Miscellaneous improvements.	3,000,000
	1970-73 - Corte Madera Creek (Corps of Engineers).	5,000,000
	1975 - Novato Creek.	7,000,000
	1975 - Mill Valley Creek.	7,000,000
Belvedere	1972 - Diversion of stormwater from Belvedere Lagoon to Richardson Bay and/or Belvedere Cove to eliminate silting of Lagoon.	150,000*
Corte Madera	New Master Flood Control Plan.	
Fairfax	NIR.	
Larkspur	1971-75 - Upgrading of system in specific areas.	100,000
Mill Valley	NIR.	
Novato	1972 - Rush Creek Headwaters - Downtown Area (present local flooding).	900,000*
	1973 - Northwest Quadrant Area (present local flooding).	600,000*
	1975 - Downtown Area, collectors and laterals.	250,000

Table 24 (Continued)

Agency	Description of Project	Capital Cost Estimate
Marin County		
	1974-78 - Miscellaneous collector and lateral facilities.	$ 400,000
Ross	1971 - Upgrading of existing storm drainage facilities and construction of new needed works.	100,000
	1972 - Same as above.	75,000
	1973-75 - Same as above.	50,000/yr
	1976-79 - Same as above.	30,000/yr
San Anselmo	1972 - Ross Ave. drain.	75,000
San Rafael	1971 - Bret Hart Area drainage.	200,000
	1972-74 - Completion of drainage system including major pumping station.	800,000
	1975 - Sun Valley drainage area.	500,000
	1976-78 - Acquire R/W, construct drainage facilities.	1,500,000
	1979 - Miscellaneous drainage improvements.	250,000
Sausalito	1971 - Expansion.	15,000
	1972 - Same as above.	15,000
	1973 - Same as above.	10,000
	1974 - Same as above.	5,000
Tiburon	Being studied.	
Napa County		
Napa County FCD	Corps of Engineers, Napa River project.	Indeterminate
	Soil Conservation Service, watershed work plan on Napa River.	Indeterminate

Table 24 (Continued)

Agency	Description of Project	Capital Cost Estimate
Napa County		
Calistoga	NIR.	$
Napa	1975 - Completion of storm drainage facilities in older city of Napa areas.	6,000,000 to 7,000,000*
St. Helena	None.	
Yountville	NIR.	
City and County of San Francisco	1970-76 - Enlargement of inadequate sewers and reconstruction of unsound sewers.	3,000,000 to 4,000,000/yr*
San Mateo County		
San Mateo County FCD	1971 - East Palo Alto, Belle Haven Unit I.	1,600,000
	1971 - East Palo Alto, Belle Haven Unit II.	5,100,000
	1971 - Sequoia tract drainage project.	1,000,000
	1971 - Denniston Creek.	500,000
	1980 - Fair Oaks.	2,100,000
	1980 - El Granada.	1,300,000
Atherton	1971 - Polhemus drain line.	275,000
	1971 - Ringwood area drain.	75,000
	1971 - Barry Lane - Monte Vista lining.	75,000
	1972 - Camino al Lago - Alameda drain.	30,000
	1972 - Alameda - Reservoir Road lining.	125,000
	1973 - Reservoir Road - Valley Road lining.	75,000
	1978 - Marsh Road culvert.	275,000

Table 24 (Continued)

Agency	Description of Project	Capital Cost Estimate
San Mateo County		
Belmont	NIR.	$
Brisbane	1971 or 1972 - Storm drains for central Brisbane.	400,000*
Burlingame	None.	
Colma	None.	
Daly City	1972 - East Market St., 66-inch line.	150,000
	1975 - Vista Grande effluent line.	4,000,000
Half Moon Bay	None.	
Hillsborough	None.	
Menlo Park	NIR.	
Millbrae	1971 - Lomita Canal flap gates.	12,000*
	1971 - El Camino Real - Park Blvd. storm drain.	17,000*
	1972 - Lomita Ave. drainage.	10,000*
	1972 - Airport Park culvert extension.	20,000*
	1973 - Lomita Canal, convert pumps to diesel.	20,000*
Pacifica	1971 - Edgemar Big Inch Creek.	110,000
	1973 - Pacific Manor - Milagra.	200,000
	1973 - Saluda Beach.	80,000
	1974 - Brighton Beach, Pumping station and discharge.	185,000
	1975 - Vallemar - Calera Creek.	300,000
	1975 - Rockaway Beach.	108,000

Table 24 (Continued)

Agency	Description of Project	Capital Cost Estimate
San Mateo County		
	1975 - Linda Mar - San Pedro Bridge.	$ 27,000
	1979 - Linda Mar - San Pedro Creek, bridge and culvert structures.	300,000
Portola Valley	No schedule has been adopted. Deficiencies - Phase I.	295,000*
Redwood City	None.	
San Bruno	NIR.	
San Carlos	NIR.	
San Mateo	1971 - Remedial work.	100,000*
	1973 - Expansion of existing system.	1,000,000
	1975 - Same as above.	1,000,000
	1978 - Same as above.	2,000,000
South San Francisco	1973 - Spruce Ave. (Commercial to Miller) drain.	50,000
	1974 - Industrial Branch storm drain.	515,000
	1975 - Brentwood storm drain.	62,000
	1976 - Shaw Road low area pumping project.	175,000
	1977 - Colma Creek improvement through city.	20,000,000*
	1978 - Mission Road storm drain.	63,000
	1978 - El Camino Real storm drain.	106,000
	1979 - Central city drainage improvements.	200,000
Woodside	None.	

Table 24 (Continued)

Agency	Description of Project	Capital Cost Estimate
Santa Clara County		
Santa Clara County FCD	Adobe Creek	
	1971.	$ 180,000
	1972.	230,000
	1973.	70,000
	Barron Creek	
	1971.	200,000
	Palo Alto Flood Basin	
	1971.	255,000
	1972.	500,000
	1973.	345,000
	Permanente Creek	
	1975.	400,000
	Stevens Creek	
	1971.	355,000
	1972.	175,000
	1974.	100,000
	1975.	115,000
	Bay Front Levees	
	1972.	280,000
	1973.	320,000
	1974.	400,000
	Calabazas Creek	
	1971.	1,200,000
	1972.	750,000
	1973.	320,000
	1974.	680,000
	1975.	1,170,000

Table 24 (Continued)

Agency	Description of Project	Capital Cost Estimate
Santa Clara County		
	San Tomas Aquino Creek	
	1971.	$ 200,000
	Saratoga Creek	
	1974.	1,170,000
	1975.	1,340,000
	Smith Creek	
	1973.	390,000
	1974.	180,000
	Guadalupe Slough	
	1972.	550,000
	1973.	550,000
	Sunnyvale East Channel	
	1973.	390,000
	1974.	180,000
	Alamitos Creek	
	1971.	670,000
	1972.	1,320,000
	Alviso Slough	
	1971.	520,000
	Guadalupe Creek	
	1971.	200,000
	Guadalupe River	
	1973.	300,000
	1974.	1,900,000
	1975.	2,070,000

Table 24 (Continued)

Agency	Description of Project	Capital Cost Estimate
Santa Clara County		
	Los Gatos Creek	
	1971.	$ 600,000
	Silver Creek - Lower	
	1974.	800,000
	1975.	1,050,000
	Silver Creek - Upper	
	1971.	600,000
	1972.	280,000
	1973.	160,000
	Llagas Creek	
	1971.	1,184,000
	1972.	1,664,000
	1974.	1,200,000
	1975.	956,000
	Miller Slough	
	1973.	302,000
	Ronan Channel	
	1971.	570,000
	1973.	1,128,000
Santa Clara County Public Works Department	Midwestern additions and expansion.	890,000
	Northeastern additions and expansion.	2,060,000
	Central expansion.	900,000
Campbell	NIR.	

Table 24 (Continued)

Agency	Description of Project	Capital Cost Estimate
Santa Clara County		
Cupertino	NIR.	$
Gilroy	1971 - Chestnut St. storm drain, new.	20,000
	1972 - Alexander St. storm drain, new.	15,000
	1973 - Second St. storm drain, replacement.	10,000
	As soon as possible - Soil Conservation Service program approved but not funded by Congress.	3,000,000 to 4,000,000*
	1974 - Morey - Kern - Wren storm drains, new.	35,000
	1976 - Luchessa Ave. storm drains, new.	50,000
	1975-80 - Miscellaneous.	50,000
Los Altos	None.	
Los Altos Hills	1970 - East Branch Barron Creek, improve channel.	56,000*
	1970 - Reconstruct and replace culverts, catchbasins.	15,000*
	1975 - Improve drainage channels.	32,000
	1980 - Same as above.	163,000
Los Gatos	1970 - Los Gatos - Almaden - Lester Lane.	20,000
	1970 - West Main St. trunk.	70,000
	1971 - San Jose Ave. trunk.	45,000
	1971 - Santa Cruz - Andrews St. - SPRR trunk.	20,000
	1972 - Blossom Hill Road trunk.	14,000

Table 24 (Continued)

Agency	Description of Project	Capital Cost Estimate
Santa Clara County		
	1972 - Pollard Road extension trunk.	$ 18,000
	1973 - Main St. trunk, Jackson to civic center.	20,000
	1973 - Pennsylvania Ave. trunk.	17,000
	1974 - Apricot Lane interceptor trunk.	25,000
Milpitas	1970-80 - Construction of local drainage facilities as required by new developments and street improvements.	Indeterminate
Morgan Hill	NIR.	
Mountain View	1970-80 - Collection system improvements in remainder of service area.	1,500,000
	1973-80 - About 800 acres north of Bayshore Freeway. Although a development plan has not yet been prepared, possible drainage plans have been estimated roughly.	2,000,000
Monte Sereno	None.	
Palo Alto	1971-75 - Installation of additional storm drainage facilities throughout the various sections of town.	2,427,000
San Jose	1970-80 - Expansion of storm drainage system and new storm drainage systems.	12,000,000
	1970-80 - Remedial work or replacement of old facilities.	1,500,000
Santa Clara	1970-80 - Miscellaneous new, required by major street improvements.	270,000
	1970-80 - Storm sewer, Master Plan north of Bayshore.	2,349,000

Table 24 (Continued)

Agency	Description of Project	Capital Cost Estimate
Santa Clara County		
	1970-80 - Storm sewer, Master Plan south of Bayshore.	$ 131,000
	1970-80 - Main replacements.	405,000
	1971 - Agnew Hospital flume.	135,000
Saratoga	None.	
Sunnyvale	1970-71 - Short main extensions in downtown area.	3,000
	1973-74 - Upgrade residential areas and new pump station.	160,000
Solano County		
Benicia	1971 - Planning.	10,000
	1972 - 36-inch storm drain West 7th St. area.	40,000
	1973 - Replace inadequate size pipe.	200,000
	1974-80 - Storm drains not now piped.	300,000
Dixon	1975 - Dickson Creek storm drain.	30,000
Fairfield	NIR.	
Rio Vista	NIR.	
Suisun City	1971 - Additional pumping (south).	5,000*
	1980 - McCoy Creek channel.	200,000
Vacaville	1970-75 - Storm drains.	200,000
	1970-80 - Improve Alamo Creek.	3,000,000
	1970-80 - Clear and riprap sections of Ulatis Creek.	Indeterminate
Vallejo	NIR.	

Table 24 (Continued)

Agency	Description of Project	Capital Cost Estimate
Sonoma County		
Sonoma County Water Agency	NIR.	$
Cloverdale	NIR.	
Cotati	1972 - Update existing facilities.	70,000*
	1974 - Additions to system.	50,000
	1976 - Same as above.	20,000
	1978 - Same as above.	30,000
	1980 - Same as above.	40,000
Healdsburg	1970 - Powell Ave. storm drainage.	20,000*
	1973 - South Fitch Mt. Road.	50,000*
	1975-77 - Line an existing drainage slough west of downtown area.	150,000
Petaluma	1971 - Washington St. storm drain.	7,000*
	1971 - "H" St. storm drain.	25,000*
	1972 - Western Ave. North Fair St. storm drain.	48,000
	1972 - 12th St. culvert.	7,000*
	1973 - Cherry Valley storm drainage.	100,000*
	1974 - Wilson St. storm drain and pump Petaluma River (Corps of Engineers and Sonoma County Water Agency).	100,000
Rohnert Park	NIR.	
Santa Rosa	1971 - Summerfield Road.	10,000
	Clover storm drain.	275,000
	1972 - Ninth St. storm drain.	150,000

Table 24 (Continued)

Agency	Description of Project	Capital Cost Estimate
Sonoma County		
Sebastopol	1971 - Litchfield Creek - Palm Ave. conduit.	$ 125,000*
	1971 - Robinson Road culvert.	1,000*
	1973 - Washington Ave. - Nelson Way storm drain.	25,000*
	1973 - Huntley St. - Neva St. culvert.	7,000*
	1975 - Eddie Lane storm drain.	10,000
	1975 - Ragle Road storm drain.	8,000
Sonoma	None.	

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2. Sheaffer, J.R., J.A. Starr, G. Davis, and A. Richmond, Metropolitan Water Resource Management, Center for Urban Studies, University of Chicago, 1969.
3. "Phase I Regional Water, Sewerage, and Drainage Plan," Association of Bay Area Governments, Berkeley, California, July 1970.
4. "Regional Plan 1970: 1990, San Francisco Bay Region," Association of Bay Area Governments, Berkeley, California, July 30, 1970.

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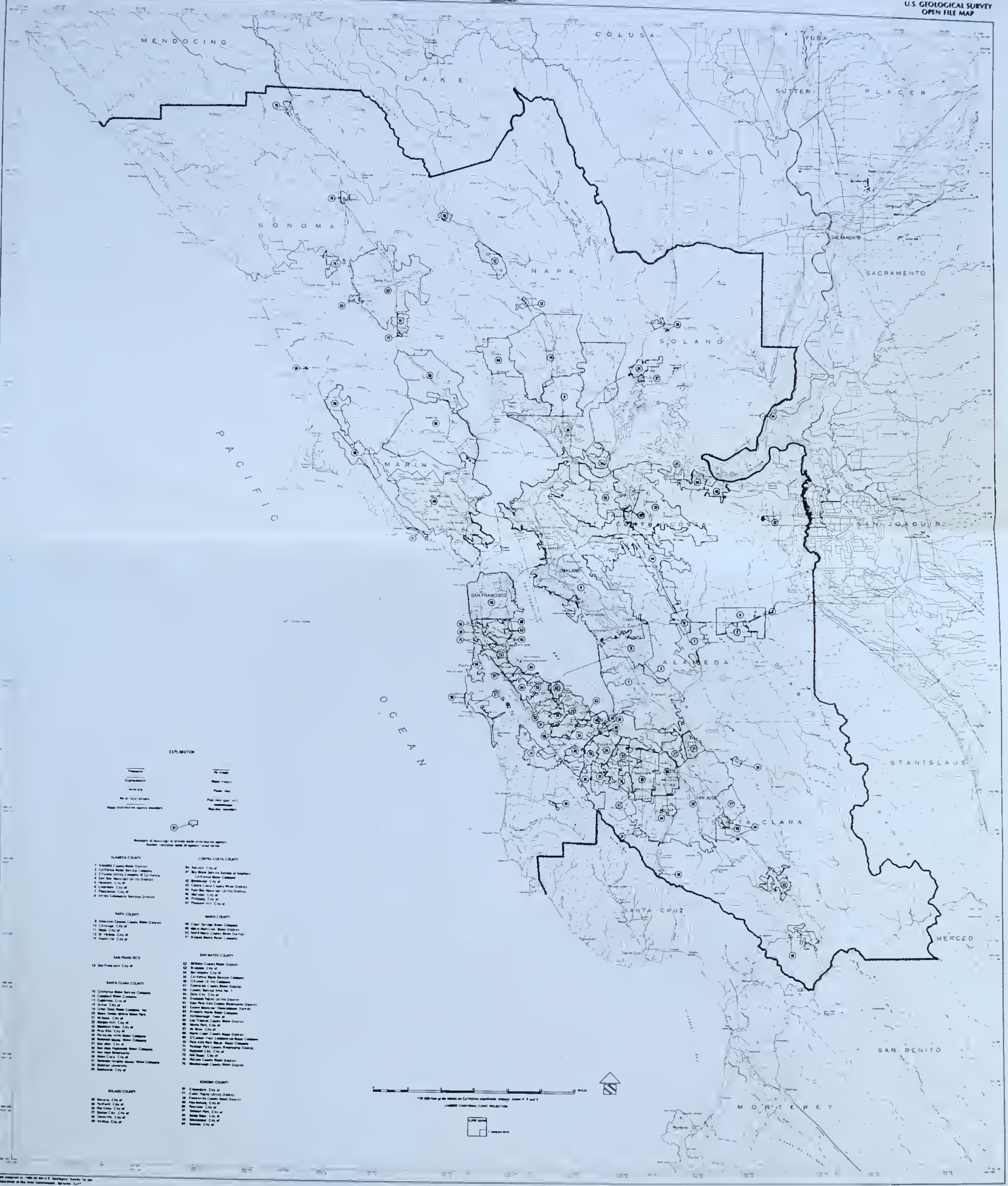
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

Prepared in cooperation with the
DEPARTMENT OF HOUSING AND URBAN
DEVELOPMENT

U.S. GEOLOGICAL SURVEY
OPEN FILE MAP



MAP SHOWING AREAS SERVICED BY MUNICIPAL AND PRIVATE WATER-DISTRIBUTION AGENCIES, SAN FRANCISCO BAY REGION, 1970

COMPILED BY J. T. LIMERINOS AND KAREN VAN DINE

FIG. 3

ASSOCIATION OF BAY AREA GOVERNMENTS